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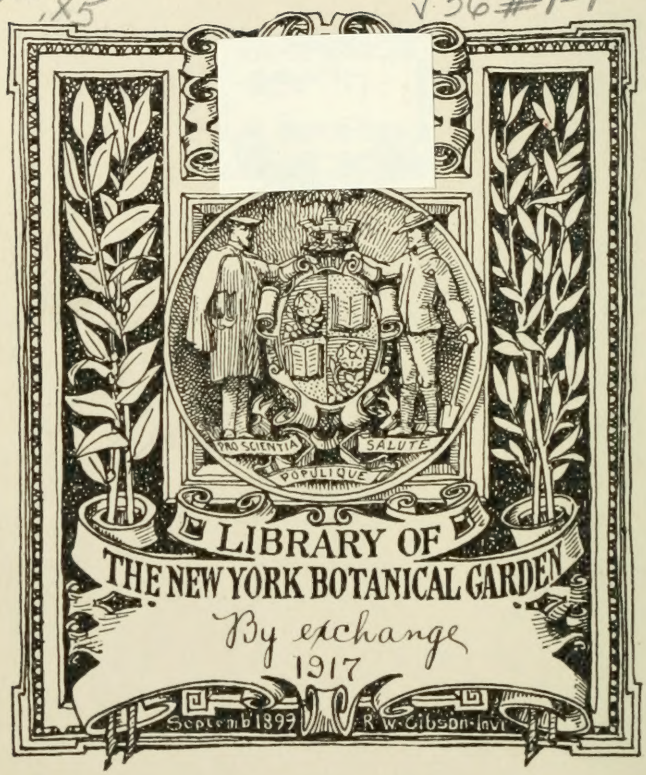
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EXPERIMENT STATION RECORD.

VOL. 36. JANUARY, 1917. No. 1.

The annual meeting of the American Association for the Advancement of Science is one of the great scientific events of the year. It is a vast clearinghouse for ideas and results in science, and for the testing and molding of views. It presents the largest forum in this country for healthy, tempered but searching criticism in science, without which science becomes self-complacent, lax, and unexacting in its requirements.

Beyond this, such a meeting of men associated with the various branches of science has a remarkably broadening influence. One gets new insight, suggestion, and inspiration from such a contact of minds, such a presentation of evidence, such a weighing and testing of results and of views. The individual finds anew that his branch of science or his specialty has relations beyond the narrow limits in which he has been considering it, and that there is not only an interest in following this broader relation, but a danger unless he does that he may specialize too closely in his thinking and view his subject out of focus.

Hence it seems worth while for the man of science to foregather from time to time with his colleagues in the annual convocation, worth the time and worth the money outlay. This is not so much to listen to papers which might be read or to present a report which might be published, but to keep his mind from narrowing, to maintain a contact with science which is well nigh impossible otherwise, and an association which contributes so much to the zeal and the satisfaction of a scientific career. It brings him definitely into membership in that great fraternity of workers in the broad field of science—some for its own sake, some for its relations to human welfare, all having the common purpose to advance knowledge and understanding. It was the belief in such advantages that led thousands of men and women to journey long distances, many from the South and the West, to attend the New York meeting.

The relation to agriculture of considerable parts of the programs of various sections and affiliated societies seems increasingly greater with each succeeding meeting. Perhaps it is because our interest is broadening. Perhaps it is because the investigation in agriculture

is leading more and more deeply into the realm of the sciences. And undoubtedly it is because interest in these problems is becoming more widespread, for the problems of agriculture are now attracting the attention of very many men and women identified with nonagricultural institutions. The biological chemists, the various botanical organizations, the entomologists, the zoologists, the geneticists, the ecologists, all had papers of immediate import to agricultural investigation. Indeed, there were so many of these contributions and discussions that the difficulty was to hear more than a small part and to make a selection.

The Section of Agriculture confined its program to a single session, in order to avoid conflict with the programs of other agricultural organizations meeting during the week. The session was presided over by Dr. W. H. Jordan, of the New York State Experiment Station. Unfortunately the retiring vice president, Dean E. Davenport of Illinois, was unable to reach the meeting owing to delayed railroad transportation, and his address accordingly had to be omitted. The program consisted of a symposium on The Adjustment of Science to Practice in Agriculture, participated in by Dr. H. J. Wheeler of Boston, Dr. J. G. Lipman of New Jersey, Dr. G. F. Warren of Cornell University, and Director B. Youngblood of the Texas Station.

Taken as a whole, this discussion was a frank acknowledgment of the present limitations of our agricultural knowledge, especially the full understanding of it, and some of the difficulties in its application in successful farming. It was a somewhat critical analysis of experimental methods, and it sounded a caution against premature generalization from laboratory results to the farm. The more we study and learn, the clearer it becomes that science may not always be applied equally and uniformly under existing local, economic, and other conditions, and that safe teaching requires consideration of many things. The keynote of the discussion was the conduct of broader and more searching inquiries and greater caution in their interpretation. As Dr. Jordan stated, the stations have been and are still putting too much time on mere variables that have no broad significance, and too little time on broad fundamentals. He called attention to the fallacy and unwisdom of attempting to state results in terms of dollars and cents, since these have no real permanent or scientific significance.

In considering some factors lying between scientific results and the farm, Dr. Wheeler grouped these factors under the heads of political, economic, and technical. Holding that agriculture needs to be stimulated by political action, so as to provide not only favorable but

stable conditions for the industry, he maintained that a depressed condition of agriculture is generally unfavorable to the application of science. The encouragement of private ownership of land, adjustment of the size of the farm to the farmer's capacity, and the establishment of industries like beet sugar and potato drying, which distribute and give employment to the farm laborer, all make for general conditions under which science can be effectively and profitably applied. Education is another great factor in making science applicable. Illustrations were cited from Germany to show how such favorable conditions have been a means for developing agriculture upon a high plane and placing it upon a broad scientific basis.

On the technical side emphasis was laid on the importance of the true interpretation of science in practice. This has not always followed from investigation, as was shown by numerous illustrations. It results from a broad generalization from laboratory experiments under artificial conditions to terms of general practice. Attention was called to some of the factors which may upset the laboratory results and conclusions when they come to be applied, such as soil type, climatic conditions, the inducing of disease, etc. The present receptive condition of the farmers and their readiness to adopt suggestions make it doubly important that our teaching should be sound.

Considering the subject of the limitations of science to progress in agriculture, Dr. Lipman, while recognizing that in a strict sense there are no limitations in science as long as we keep within natural laws, pointed to certain human limitations in the development of science and in its successful application in practice. He advocated with much force the adequate preparation of men for research in agriculture as essential if the present limitation is to be removed. Lack of vision was cited as a most frequent deficiency; the outlook needs to be broader as our problems become more difficult and complex.

The greatest present limitation of science in agriculture was considered to be its effective application. The man power is the real measure of efficiency in production, rather than the acre yield, and the increase in this efficiency rests upon the spread of education. To raise the scale of production there must be a higher level of education among the mass of farmers, to bring up those below the average and to raise the average up to the better ones. Economic conditions constitute another type of limitation in determining the extent to which scientific knowledge can be applied in practice, as do also lack of working capital, location remote from market or from transportation facilities, and the lack of cooperation among producers. The latter was regarded as an especially serious limitation, because single-handed the American farmer is frequently not able to fully

utilize the findings of science as would be possible in applying these to broader areas.

The relation of economic factors was further discussed by Dr. Warren, who held that in applying science to industry no method is scientific which fails to count the cost. The farmer must take account of this before he is warranted in making radical changes, but it is not always done in making practical deductions from scientific findings. He contended that agriculture is not the inefficient art that it has often been represented to be, and that while it can be improved the chances for improvement are less than in most other industries. In a region of settled farming, radical changes in the type of farming are justified only after careful study of all the factors involved.

Transportation affects the application of science, for it should in large measure determine the type of farming. Sugar can be shipped long distances; hence New York can not afford to grow its own sugar, although the climate and soil are favorable and there was a vigorous effort to establish the industry. Risk was cited as an important factor in tending to hold down the intensity of farm practice. Whenever one factor of cost is changed it is probable that others will be changed also. For example, with better cows the cost is increased and the net advantage may be smaller than is indicated by the difference between feed cost and value of product. Other examples of diminishing returns were cited to show the dangers in making practical application of scientific results without weighing carefully all the economic and practical considerations.

The effect of regional conditions as determining the type of agricultural inquiry was considered by Professor Youngblood, who used for illustration the State of Texas. The variation within the State in rainfall is from fifty-five inches in the east to about eight inches in the extreme west, in elevation from sea level to approximately five thousand feet, in topography from flat to rough, in temperature from semitropical to strictly temperate, and the soils of different localities are derived from various phases of at least ten geological periods. Beyond these physical differences the general character of agriculture, the distance from market, and the intellectual status of the people all have to be taken into account in adjusting the agricultural inquiry to the needs. Without omitting the fundamentals, account must be taken of the practically useful and applicable information in laying out the station's work. Since the object of the station is service, both present and future, "we should endeavor to educate the people up to the point of appreciating all investigation, however simple or technical, by assisting them to appreciate the possible value of the results which may ultimately be obtained."

The speaker thus made clear in how large a degree regional conditions affect the type and the grade of experimental work. His plan is to develop at the central station a strong scientific basis on which to rest the experiments dealing with special local problems. He expressed his conviction that even under the new and often transitional conditions in his State, technical studies may be of the greatest practical value and may be made popular with the people.

This series of papers represented much thoughtful study. It is difficult to give an adequate idea of them in so brief a review. They are worthy of publication in full, for they put into succinct, cogent form a series of considerations which are fundamental to safe progress at the present time.

The old questions as to what research is, how investigation should be organized, how men should be trained for it, how coordination or correlation can be brought about, came to the surface again, especially in the meetings of the Society for Horticultural Science and the Society of American Foresters. These matters can not be too fully discussed. We are not at the end in our understanding of them or in providing measures for their accomplishment.

The Society for Horticultural Science last year appointed a committee on research and experimentation, which reported at the New York meeting through Dr. L. H. Bailey, its chairman. The report was divided into three parts, namely, a definition of terms, by Dr. W. L. Howard, of California; the laying out of an experiment, by Dr. H. J. Webber, of the California Citrus Experiment Station; and the training of the investigator, by the chairman.

Dr. Howard's paper gave an admirably clear and intelligent view of the different classes of experimental effort. These are characterized by their ultimate purpose quite as much as by their method. In explaining his meaning he compared the discoveries of the Indians, which meant little to them beyond supplying their own immediate wants, to those of the early explorers of this country, to whom the finding or exploring of a river was a means to an end, who "sought outlets, gateways, to their own or other countries, which might be an aid to settlement and commerce."

Again he explained that a man may take a walk without the intention of going anywhere in particular and get benefit from it, or he may set out for some definite place or to search for some rare or elusive object. The first instance was likened to a simple experiment, while the latter was described as more in the nature of research. "A simple experiment may be performed and actually answer the question and may stop there. Also, in answering the question another question may be raised which may require another experiment or

test. This in turn may be similarly tested and decided, when others may arise, and so on; but all such tests remain in the category of experiments. During the course of the experiments, however, the experimenter may come to the conclusion that there is some hidden reason at the bottom of all his tests which may explain why he has been getting certain results—something that will clear up the whole situation."

Applying this to pollination studies, Dr. Howard traced the imaginary progress of successive tests and experiments showing that certain varieties are self-sterile and that others are good pollinizers for these varieties, and that certain varieties are intersterile while a certain few are safe pollinators for many—all facts of practical value but giving no clew to why a certain variety is fertile or self-sterile. This may lead the experimenter to theorize as to the possible reason and the series of experiments to approach the stage of investigation. "When a definite program has been mapped out which has for its object the finding out of the cause or causes which underlie self-fertility or self-sterility in general, or for the particular fruit in question, with a logically arranged set of experiments for pursuing the inquiry, the problem develops at once into a genuine piece of research."

This explanation characterizes the different grades of inquiry with unusual clearness. It explains at once the quality and method of the inquiry when it reaches the research stage, and it makes it clear why an experimenter can not embark upon a piece of research until he has a purpose which lies beyond the accumulation of facts and a theory or hypothesis which guides him in elaborating a plan. It also makes clear the importance of the project outline, and the reasonableness of the requirement. For clearly the title alone does not disclose the nature of the effort: it only tells what the contemplated work is about and what field it lies in. A statement of the object and the plan of procedure is the only basis for a fair and intelligent judgment of the undertaking, for it enables a determination of whether the effort is to consist in a series of tests, the gathering of unrelated facts, the making of observations on phenomena, or whether it contemplates a study of phenomena in their relations to one another. Hence the project outline is an administrative necessity. It furnishes evidence of deliberation and forethought. It is not an attempt to anticipate results but a deliberate effort to devise a promising means of getting them for a specific purpose. And it is not fixed or stereotyped; the project soon becomes sterile unless the plan grows with the progress of the study.

As Dr. Howard well stated: "Experiments are necessary steps in carrying on research work, but it is also clear that research is much

deeper than experimentation. Experimental tests of various kinds are necessary and perfectly justifiable, and always will be, and more experimental work should be encouraged, but experiments as such should not be confused in their meaning and objects with the scope and ultimate aims of research."

As Dr. Bailey explained in commenting on this paper, the characterization of research lies in its intent. Facts alone do not make research—they make tables. Dollars and cents are not the terms of research; its interpretation lies in its own language. Application is not necessarily a part of research; the object is to discover and express the truth. It does not depend on the size of the undertaking or the money spent upon it. Because it is an attitude and a spirit it can not be definitely defined. But Dr. Howard's excellent paper will help much in defining its qualities and distinctions.

In discussing the method of laying out an experiment, Dr. Webber divided the investigations of an experiment station into two classes, individual and institutional problems, *i. e.*, (1) problems of limited nature which can best be handled by an individual investigator, and (2) those which because of their breadth and time requirement concern the whole institution and involve several departments. The leader of an individual problem, it was urged, should be given the greatest possible scope of freedom in planning and executing his work; his success will depend upon his individual initiative and originality.

The case with the institutional problem is different. Here many persons are concerned and there is need of harmonious action. As an illustration of this class, a fertilizer experiment with orchard fruits was cited, "if it is correctly planned and manned," because it is expensive in time and funds and concerns a number of departments of the station. Regarding the essentials of such a study, Dr. Webber said: "A fertilizer, irrigation, or cultivation experiment, if it is to have its highest value and yield the greatest number of useful lessons, must be studied by chemists, soil physicists, plant physiologists, soil bacteriologists, pathologists, and crop experts. Experiments that cost so much should be used to the maximum extent. Very few experiments of this kind now under way are being so studied. This, I believe, is in large measure due to a failure to recognize what should be individual and what institutional experiments."

This is an important statement and develops a point often overlooked. Many of our field experiments continue to be studied from too narrow a point of view because they are conducted as individual studies. Advantage is not taken of the opportunity afforded to study

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other phenomena and relationships beyond those the author of the experiment has in mind. Hence the most is not made of these expensive undertakings, important by-products are overlooked, and at the same time the experiments themselves are weakened because they do not include a complete study of the exact conditions and the changes brought about, both in the environment and in the plant response.

Dr. Webber's ideas on the method of organizing institutional experiments are interesting because the subject is so fundamental in accomplishing these broader aims. He considered two plans: (1) Through a committee comprised of men representing all the branches of science concerned in the experiment, and (2) by a strong team captain. The committee plan is more common but its danger "lies in the possibility that the plan finally adopted may be a result of compromise that will be a hodgepodge, that after all may be emasculated of its most vital points. The most valuable series of experiments in the history of science are usually those planned to solve certain points."

Here again a vital matter is touched upon, for it frequently happens, as indicated, that in such composite investigations each participant works out the part of the problem he is particularly interested in from his own point of view, and the main question which the investigation set out to solve is advanced but little because there is no common aim, no unity, no one to keep the effort focused on a definite point and to marshal the data to bear upon it. Such a plan is a distinct weakness in the study of "institutional" problems. The direction of such problems is an institutional matter. These considerations led Dr. Webber to favor the individual leader—"a strong, virile investigator with originality, vision, and training of the right kind," who would be charged with the sole responsibility of planning the experiments, getting all the help possible from the various departments, and would center the effort on the solution of certain fundamental questions, giving it definiteness and freedom from compromise.

In commenting on this paper Dr. Bailey, while fully recognizing the importance of individuality in research, pointed to the danger of such a division of institutional problems as to result in diffusion of responsibility, inequality of enterprise, and lack of coordination. In investigation of institutional problems, he held for such coordination of all parts as will give it responsibility, cohesion, and system.

Speaking of the training of the investigator, Dr. Bailey held that the research man should be a student in all that the name implies. The investigator in horticulture should have a grounding in chemistry, physics, and physiology, for the grasp they give on methods and

approach. And he should have training in systematic botany, not alone for its knowledge of plants but for its key system, for the drill in comparing things that are actually comparable. His training should also give him a contemplative, reflective habit of thought; and he should always continue to be a student. Unless he continues to acquire much of his preparation as he goes, his research spirit has got its growth. The investigator must prepare himself for each separate piece of work.

In addition to this training in the sciences, emphasis was laid on the need for much study of English, to give familiarity with words and terms in order to make sharp discriminations and comparisons, and to enable clear expression of thought and deduction. This is an all too frequent lack at present. Science is exact, in expression as well as in essence. No worker has a right to be understood except in the terms of his own language. Good training in logic was also advocated, in the weighing of evidence, because ability in that line is one of the prime essentials of the investigator.

In conclusion, Dr. Bailey suggested a small standing committee on research, one member of which might preferably be chosen from outside the field of horticultural science, to whom questions might be referred for judgment and suggestion, rather than for censorship or approval. This seems a good idea, which might perhaps be extended, as it has been in other organizations, to include the suggestion by the committee of profitable lines of work, the organization of cooperative undertakings, or provision for some measure of coordination of experiments in horticulture. This might lead to attacking common problems in a more harmonious way or on a plan which would prevent unnecessary duplication, complex subjects being divided into different phases to be carried on by individuals or groups. The society did not go that far, but the suggestion was made for an indexing and publication of the lines of investigation in progress in horticulture, possibly in the proceedings of the society, which met with approval.

A similar need for information as to what is going on was voiced in a meeting of the Society of American Foresters. This meeting developed much interest in forest investigation, and brought out not only the need of professional foresters and teachers for investigation as a basis in their work, but the readiness for it by industrial concerns and large lumber producers.

The experimental and research work in progress in the Forest Service was described in an interesting paper by Mr. E. H. Clapp of that Service, who explained the extent to which wood producers are found to be lacking in knowledge of the real fundamentals of their business. Practical men are now realizing the lack of depend-

able information and are ready to make use of the teachings of investigation. The special demand at the present time is in the field of forest products, but to those engaged in investigation the field now appears much larger than it did at the beginning, and they realize that demands will be upon them long before they can be ready to meet them.

While the Forest Service is the largest center for investigation, experimental work is going on incidentally in many other places, but, as was pointed out, there is no cooperation or correlation, and no means of knowing what others are doing. The advantage of the periodical publication of projects was emphasized, and the correlation of the forest investigations of the country was advocated. Such a correlation, it was explained, would be wholly voluntary and brought about by suggestion; but some provision for it was deemed especially desirable in these early stages of investigation, before the plans became so crystallized and fixed that changes can not well be made.

The proposal for coordination brought forward some doubt as to its desirability or feasibility, and an expression of the difficulty of cooperation or coordination in research similar to that advanced when cooperation in agricultural investigation has been under consideration. It is noteworthy in these discussions, however, that the term "research" is used in a generic sense to include the various grades of experimental inquiry, while those who have advocated a larger measure of coordination and cooperation have not applied the argument to research in its more strict sense.

There seems to be quite widespread objection to any proposal which aims to bring experimenters together or harmonize the plans for their experiments. Is it because our investigation in agriculture and forestry is so much younger than that in the sciences, and lacks background to give confidence in the attempt of men to cooperate with one another? Or is it purely academic, in the belief that even the simpler forms of experimentation should not be related for fear they will be stereotyped or possibly centralized, but should be left wholly to the independent worker? Suggestion has been a powerful influence with the rank and file of experimenters in the past. Very much of our experimental work in agriculture has followed the lead of the few, but not in a manner to contribute in the largest measure to confirmation or to progress.

The same feeling does not seem to prevail in the older sciences; the astronomers have long worked under a common agreement which rests upon a division of the field, the chemists have cooperated in the study and development of methods, the botanists have encouraged the development of special lines by groups of workers, and the geographers have had an effective international agreement relative to map

making. Recently the ecologists have embarked upon a large program of cooperation on climatology in relation to plants and animals.

This latter enterprise has been developed in the Ecological Society of America, established a year ago, through a climatological committee. Cooperative studies in special lines are being participated in by a considerable number of workers. One subcommittee has to do with soil temperature as an environmental factor of special interest to entomologists and pathologists, to foresters, to crop specialists, and a wide range of workers. This subcommittee has organized soil temperature studies, to be carried on cooperatively in accordance with a relatively simple plan, and has met with ready response from investigators, who have been willing to put funds into the work and adhere to a plan which would make their results comparable. The undertaking recognizes that there must be leadership and plan, with provision for assembling the data, but it also recognizes that the plan should be a simple one, should not attack too large a question at any one time, and should allow the maximum individual liberty consistent with comparative data. The effort is especially interesting because of the faith it shows and the response there has been to it.

Cooperation or coordination can not be forced and it can not thrive unless there is a spirit and attitude on the part of the individuals and the institutions, which recognizes the limitations of the individual and the fact that in many things science and the common good can best be promoted by a closer union of effort.

At present there seems to be widespread interest in some means of giving fairly prompt publicity to the lines of investigation in progress, in order that investigators may know what experiments and researches are being conducted in the lines they are especially interested in, and where this work is going on. This is an encouraging sign. It offers a means of approach. The provision of information regarding lines of work and specific undertakings would furnish a means by which investigators who desired could draw closer together, and by which unnecessary duplication could be avoided and the results of separate experiments made to supplement one another more definitely.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Studies in the physical chemistry of essential oils (*Proc. Roy. Soc. Victoria, n. ser., 27 (1915), No. 2, pp. 149–163, figs. 2*).—Two papers are presented.

I. *The physical properties of mixtures of two terpene substances in relation to those of the constituents*, R. B. Drew and E. I. Rosenblum (pp. 149–155).—The results of the study show that simple mixtures of two terpene compounds follow the "mixture law" quite closely. Any divergencies are eliminated by the use of certain formulas. For such mixtures the proportions of the constituents can be calculated from the properties of the mixture, provided none of the constituents are unstable. In such cases the deductions are unreliable.

II. *The physical constants of some terpenes and oxygenated derivatives thereof, and their variation with temperature*, E. I. Rosenblum (pp. 155–163).—The influence of temperature change on the density, refractive index, and rotation of a number of terpenes and allied substances has been investigated, and the results are submitted in tabular and graphical form.

Some numerical relations among the rotatory powers of the compound sugars, C. S. Hudson (*Jour. Amer. Chem. Soc., 38 (1916), No. 8, pp. 1566–1575*).

The isomeric alpha and beta hexacetates of α-glucoheptose, C. S. Hudson and E. Yanovsky (*Jour. Amer. Chem. Soc., 38 (1916), No. 8, pp. 1575–1577*).

α-Crotonic acid, a soil constituent, E. H. Walters and L. E. Wise (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 25, pp. 1043–1046, pl. 1*).—The authors have isolated α-crotonic acid from a Susquehanna fine sandy loam found in a field near Marshall, Tex. The soil was of such a nature as to present optimum conditions for the formation and accumulation of organic acids.

The acid was isolated from an alkaline extract obtained by treating the soil with an aqueous 2 per cent sodium hydroxid solution for 24 hours at room temperature. The extract thus obtained was slightly acidified with sulphuric acid and filtered. The acid filtrate was extracted with ether, the ether extract evaporated to about 200 cc., and aldehydes and similar substances removed by treatment with sodium bisulphite. The bisulphite solution was extracted several times with fresh ether, the ether extracts combined, and slowly evaporated to a brown sirup in a small crystallizing dish. The dish was then covered with a watch glass containing ether and maintained at a low temperature on a steam bath. A white crystalline solid gradually sublimed on the watch glass. The sublimed substance was dried between filter paper, recrystallized from petroleum ether, further purified by subliming several times at a low temperature, and finally dried over anhydrous calcium chlorid. Physical and chemical tests identified the material as α-crotonic acid.

It is suggested that the acid is possibly formed in soils "during the destruction of cellulose, from β-hydroxy acids of the aliphatic series, or by the hydrolysis of allyl cyanid, which is found in the essential oils from certain plants."

Biochemical changes in cotton seed in storage, J. B. Rather (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, pp. 604–607, figs. 2*).—This material has been essentially noted from another source (E. S. R., 35, p. 412).

Experiments upon the amylase of Aspergillus oryzæ, H. C. SHERMAN and A. P. TANBERG (*Jour. Amer. Chem. Soc., 38 (1916), No. 8, pp. 1638–1645*).—From the study reported, the object of which was to purify the amylase as far as practicable and to compare its nature and properties with those of the pancreatic and malt amylases, it was found that the amylase of *A. oryzæ* exerts its maximum activity in a very slightly acid medium. Acid phosphate accelerates the action, while alkaline phosphate retards it. "Addition of neutral electrolytes, such as sodium and potassium chlorids, to commercial taka-diastase has no measurable effect upon the saccharogenic power, but does increase the amyloclastic action."

The best preparations were obtained by extracting with water, precipitating with ammonium sulphate, dialyzing, and finally precipitating fractionally with alcohol. Such preparations are about thirty times as active as the commercial material from which they are prepared, but are not so active as the purified pancreatic amylase.

"The purified material resembled the preparations of pancreatic and malt amylases in most of its chemical properties. It gave typical protein reactions when submitted to the Millon, xanthoproteic, tryptophan, and biuret tests. Heated in water solution it underwent coagulation, and the coagulum and filtrate both showed the biuret reaction, the color being considerably pinker in the case of the filtrate than with either the coagulum or the original material. That its nitrogen content was lower than that of the best preparations of pancreatic and malt amylases may be due either to a difference in the chemical nature of the enzym itself or to the presence of other substances which the methods of purification thus far developed do not wholly remove."

Researches on the enzyms of the blood in the albumin and globulin fractions of the serum, G. SATTA (*Arch. Ital. Biol., 64 (1915), No. 1, pp. 118–122*).—It is shown, by separating the blood serum into its albumin and globulin fractions, that the tributyrinase, amylase, and glycyltyrosinase of the blood serum exist exclusively in the albumin fraction.

A nonspattering wash bottle, F. C. CLAPP (*Jour. Amer. Chem. Soc., 38 (1916), No. 8, pp. 1502, 1503, fig. 1*).—The author, at the Minnesota Experiment Station, describes a wash bottle so constructed as to obviate spattering at the tip of the nozzle. The principle of raising the water table of the wash bottle slightly above the level of the tip of the nozzle has been adopted in its construction. "Back action" is thus avoided and the nozzle tube is kept permanently full of water.

Researches on quinazolins.—XXXIII, A new and sensitive indicator for acidimetry and alkalimetry, and for the determination of hydrogen-ion concentrations between the limits of 6 and 8 on the Sörensen scale, M. T. BOGERT and G. SCATCHARD (*Jour. Amer. Chem. Soc., 38 (1916), No. 8, pp. 1606–1615*).—The authors describe the preparation and use of a dinitrobenzoylene urea, the monosodium salt of which is a very sensitive indicator for hydrogen-ion concentrations between the limits of 6 and 8 on the Sörensen scale, changing from colorless to greenish yellow. It resembles *p*-nitrophenol more closely than any of the other well-known indicators. The chief disadvantage of its use is its yellow color, which renders it unsuitable for work by artificial light. The indicator is but slightly affected by neutral salts and proteins, and not at all by chloroform or toluene. Its color fades very slightly in about a week, but is unaffected by nitrous acid. It can be used in either cold or boiling solutions. A sharp end point is obtained with ammonium hydroxid and hydrochloric acid, but it is unsuitable for use in titrating carbonates.

The opinion is expressed that in the preparation of neutral ammonium citrate for fertilizer or soil analysis it should prove superior to rosolic acid.

Kjeldahl modification for determination of nitrogen in nitro substitution compounds, W. C. Cope (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, pp. 592, 593*).—The following procedure is described:

About 0.5 gm. of the nitro substitution compound is accurately weighed and placed in a 500-cc. long-necked Kjeldahl digestion flask. Thirty cc. of sulphuric acid containing 2 gm. of salicylic acid is then added, and the nitro compound dissolved by rotating the flask or heating over a steam bath if necessary. After cooling, 2 gm. of zinc dust in small proportions at a time is added, the flask being continually rotated and cooled to prevent heating above room temperature. After all the zinc has been added the flask is rotated at 10 or 15 minute intervals for about 1.5 to 2 hours, and then allowed to stand overnight at room temperature. The flask is then gently heated over a small flame until the evolution of fumes has ceased, brought to boiling, and the boiling continued for from 1.5 to 2 hours, slightly cooled, 1 gm. of yellow mercuric oxid added, and boiled for 1.5 hours longer. After cooling, 7.5 gm. potassium sulphate and 10 cc. more of sulphuric acid are added and the mixture again boiled for 1.5 to 2 hours. If the solution is clear and practically colorless the digestion is complete. If not, 1 gm. more potassium sulphate should be added and boiling continued for some time. The distillation is then carried on and the determination completed as is usual for all modifications of the method.

In order to prevent low results, cooling during the addition of the zinc for reduction and the long standing before heating the acid solution have been found to be absolutely necessary.

Apparatus for Kjeldahl determinations, W. W. Randall (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, pp. 639, 640, fig. 1*).—In the apparatus described the acid fumes are carried off from the digestion flasks through properly fitted calcium chlorid tubes which are connected with a larger tube through which the fumes pass into a large absorption flask. The apparatus is a modification of that described by Sy (E. S. R., 28, p. 311).

Sodium sulphate as a substitute for potassium sulphate in the Gunning modifications for determining nitrogen, W. L. Latshaw (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, pp. 586, 587*).—On account of the present high price of potassium sulphate an endeavor was made to find a suitable substitute. The results of a series of determinations on materials ranging in nitrogen content from 0.039 to 14.95 per cent, using sodium sulphate in place of potassium sulphate, are reported in tabular form, and clearly indicate that sodium sulphate can be used in place of potassium sulphate for determining nitrogen in a variety of substances.

A modification of McCrudden's method for calcium, for the estimation of calcium and strontium in the presence of phosphoric acid and a small amount of iron, O. B. Winter (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, pp. 603, 604*).—The author, at the Michigan Experiment Station, has modified McCrudden's method (E. S. R., 23, p. 9) for the determination of calcium and strontium, as follows:

The solution containing the calcium or strontium or both is diluted to about 200 cc., a few drops of alizarin added, and then ammonium hydroxid until the solution is faintly alkaline. Dilute hydrochloric acid is then added to faint acidity. To this solution 10 cc. of half-normal hydrochloric acid and 10 cc. of 2.5 per cent oxalic acid are added and the mixture boiled until the precipitate becomes coarsely granulated. Saturated ammonium oxalate solution is then added, a few drops at a time, with constant stirring, until about twice the amount necessary to precipitate all the calcium and strontium has been added. The solution is cooled, 8 cc. of 20 per cent sodium acetate and about 15 cc. of

95 per cent alcohol added, with constant stirring, and allowed to stand from 4 to 18 hours. The precipitate is then filtered and washed a few times with 1 per cent ammonium oxalate solution, several times with 1 per cent of ammonium oxalate containing 20 per cent by volume of alcohol, and, finally, a few times with water containing 20 per cent by volume of alcohol. The precipitate is burned to the oxid, dissolved in nitric acid, dehydrated, the calcium nitrate separated from the strontium nitrate by means of absolute alcohol and ether, and each element then determined in the usual manner.

Analytical data submitted show the accuracy of the modified procedure.

A table for values of carbon in carbon dioxid, H. Loomis (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, p. 637*).—A table corrected for aqueous vapor, ranging from 700 to 718 mm. pressure, and from a temperature of 10 to 30° C., is submitted.

A rapid method for the accurate determination of total carbon in soils, R. M. Salter (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, pp. 637–639, fig. 1*).—A method which has been successfully used at the West Virginia Experiment Station, and which depends on the direct combustion of the soil in a current of oxygen, drying the gases by phosphorus pentoxid, and subsequently absorbing the carbon dioxid in soda-lime, is described in detail. It is an adaptation with modifications of the method described by Fleming[1] for the rapid determination of carbon in iron and steel.

The reducing action of distillates from certain carbohydrates on distillation with steam and from alkaline solution, J. P. Atkinson (*Collected Studies Bur. Lab. Dept. Health N. Y. City, 8 (1914–15), pp. 227–229*).—In the examination of a sample of water extraordinarily high figures for free ammonia with Nessler's reagent were obtained. On further examination the water was found to contain a reducing sugar. Subsequent experiments with saccharose, lactose, glucose, levulose, maltose, mannose, dextrin, soluble starch, and filter paper showed that these substances may have an influence on the depth of color in ammonia readings, especially in the examination of surface waters which are likely to be contaminated with organic matter.

The rate of ammonia distillation from water, F. W. Bruckmiller (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, pp. 602, 603*).—From a study of the rate of ammonia distillation the author concludes that sufficient information upon which to base a judgment as to the pollution of a water can be obtained, in ordinary routine water analysis, by nesslerizing three 50-cc. portions of the distillate for free ammonia, and four 50-cc. portions for albuminoid ammonia.

Melting-point determination of fats and waxes, L. Golodetz (*Chem. Ztg., 40 (1916), No. 31–32, p. 223, fig. 1*).—An apparatus in which a small, closely fitting glass tube about 3.5 cm. long and sealed at one end is placed over the end of the thermometer in melting-point determinations is described.

In making a determination the sample (about 0.2 gm.) is placed in this small tube, gently heated, the thermometer rapidly inserted, and placed in a small vial fitted with a suitable stopper. The mercury column is then closely observed and the point at which the first faint turbidity is noticed taken as the melting point. The advantages claimed for the method are constancy in the results of the determinations; the accuracy of the temperature readings, as the whole apparatus can be conveniently placed on a level with the eye; the facts that only small amounts of material are required, and that these can be used for other determinations if necessary; repeated determinations with the same sample; the rapidity of the procedure; and the simplicity of the apparatus.

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[1] Iron Age, 93 (1914), No. 1, pp. 64–66.

The detection of natural and artificial pigments in oleomargarine and butter, L. S. PALMER and W. E. THRUN (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, pp. 614–618*).—Because of the oleomargarine laws of many States it has been found necessary to detect the presence of carotin (the natural yellow pigment of animal fat) in this product. The authors have shown Cornelison's test (E. S. R., 20, p. 910) to be wrongly quoted by Leach (E. S. R., 29, p. 204). The relation between Martin's test[1] for artificial pigments in fat and Moore's test[2] for carotin added artificially to fat, as given in Leach's Food Inspection and Analysis, is shown to be confused, and the true relation is pointed out. Moore's test for carotin in fat or oleomargarine is specific not alone for carotin added artifically but is also for the carotin natural to animal fats. In this test carotin is not dissolved out of the fat, but is merely decolorized by the ferric chlorid added. The reaction involved is a reduction of the iron and the simultaneous oxidation of the carotin.

The possibility of determining whether carotin has been added to butter fat or oleomargarine is discussed.

Separation and estimation of polysulphids and thiosulphate in lime-sulphur solutions, S. D. AVERITT (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, pp. 623–627*).—The author, at the Kentucky Experiment Station, submits analytical data obtained from a comparative study of the direct iodin titration procedure of Harris (E. S. R., 25, p. 414), the method described by Thompson and Whittier (E. S. R., 32, p. 410), and two modified procedures, both of which are similar to the method of Harris, excepting that in the one tenth-normal hydrochloric acid is used instead of iodin for the monosulphur equivalent titration and in the other no attention is paid to the monosulphur equivalent titration.

"The experiments described and data presented in this paper afford new proof that calcium polysulphid in solution can be quantitatively decomposed by iodin solutions and thus eliminated from a solution containing thiosulphate, preparatory to the accurate determination of the latter."

The same result may be accomplished by means of dilute hydrochloric acid and elimination of the hydrogen sulphid formed by boiling. Sodium nitroprussid can be used as an internal indicator to show the end point of the disappearance of the sulphid in the titration with iodin. The accuracy of the iodin-titration method of Harris is confirmed.

A rapid and accurate procedure for weighing the precipitated sulphur in the iodin and hydrochloric-acid titrations of a lime-sulphur solution is proposed.

Sulphur fungicides, G. P. GRAY (*Off. Rpt. Sess. Internat. Cong. Vit., 1915, pp. 160–174*).—The author discusses the subject under the following topics: Source of the world's supply of sulphur, refining methods, kinds of sulphur, use of dry sulphur, soluble compounds of sulphur, decomposition of sulphids and thiosulphates after application to the foliage, the home preparation of some sulphur fungicides, commercial preparations of the alkali polysulphids, and the compatibility of the sulphur fungicides.

Methods of preparation and relative value of Bordeaux mixtures, O. BUTLER (*Off. Rpt. Sess. Internat. Cong. Vit., 1915, pp. 151–160*).—This is a general review of the subject, with some special reference to use on the grapevine. Some experimental data on the effect of temperature, strength in cupric sulphate, and ratio of $CuSO_4$ to CaO on the rate of deterioration of Bordeaux mixtures; the relative toxicity of neutral and alkaline Bordeaux mixtures to the spores of *Phytophthora infestans* and *Plasmopara viticola*; the effect of the method of mixing on the adhesiveness of Bordeaux mixture; and the relative rate of

[1] Analyst, 12 (1887), p. 70.
[2] Analyst, 11 (1886), pp. 163, 164.

settlement at the end of two hours of 1 per cent Bordeaux mixture at the rate of 1:1 prepared in various ways are also submitted.

The sterilization of fruit and vegetables for the home (*Cent. Committee Nat. Patriot. Organs. [Pubs.], No. 4, (1916), pp. 22, figs. 7*).—This pamphlet briefly discusses the types of containers best suited for various fruits and vegetables, selection and preparation of materials for canning, various methods of sterilization, and general notes on defects often observed in the canned products.

The sterilization of fruit and vegetables for the market (*Cent. Committee Nat. Patriot. Organs. [Pubs.], No. 5 (1916), pp. 15*).—This pamphlet describes very briefly the stages in the production of canned goods for the market. The various processes of sterilization are indicated and time-tables for sterilization included.

The recovery of potash from alunite, W. H. WAGGAMAN and J. A. CULLEN (*U. S. Dept. Agr. Bul. 415 (1916), pp. 14, fig. 1*).—The geological occurrence and origin of alunite, the location, extent, and accessibility of the Utah alunites, the production of alum, and earlier methods for the production of potash from the mineral are briefly discussed.

Experimental data obtained in igniting 11 samples of alunite from the undeveloped but readily accessible area north of Marysvale, Utah, at different temperatures and subsequently leaching the residues with water are given. A temperature between 750 and 800° C. was found to be the best for the complete extraction of potash with the minimum amount of water. Above 800° a fixation of potash took place, especially in samples containing much silica.

In determining the influence of the fineness of the material on the subsequent extraction of potash it was shown that nothing was gained by grinding the material finer than will pass a 60-mesh sieve.

In connection with the economic considerations of the industry it is suggested that it would prove more economical to ship the mineral East, taking advantage of the lower freight rates on raw material, than to manufacture the finished products near the mines, since practically all the finished products have their market in the East.

Hemp hurds as paper-making material, L. H. DEWEY and J. L. MERRILL (*U. S. Dept. Agr. Bul. 404 (1916), pp. 25, figs. 4*).—This bulletin is divided into two parts, the production and handling of hemp hurds and the manufacture of paper from hemp hurds.

By proper treatment of the hemp hurds a paper stock was obtained from which a finished product that could be classed, according to official tests, as a number one machine-finished printing paper was produced. The bulletin itself is printed on some of this paper.

Data relative to the cooking of the hemp hurds and to the official tests of the finished product are submitted in tabular form. Industrial and economic aspects of the possibilities of the industry are also discussed.

The effects of moisture introduced into the digester in the cooking of soda pulp, S. D. WELLS (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, pp. 601, 602, figs. 4*).

METEOROLOGY.

Department of meteorology, J. E. CHURCH, JR. (*Nevada Sta. Rpt. 1915, pp. 46–56*).—The work of this department of the station on forecasting frost from mountain tops, relation of mountains and forests to the conservation of snow, and the temperature survey and relation of topography to the occurrence of frost is summarized. An annotated list of meteorological publications issued during the year is given and the importance of permanently maintaining a department of meteorology in the station is discussed.

Analyzing the records at the summit of Mount Rose and at base stations of approximately 30 cold waves occurring during four years, it was found that five-sixths were felt both on the mountain and in the valley, but only one-third of these occurred sufficiently early on the mountain to give adequate warnings below (E. S. R., 35, p. 505).

From the snow studies the general conclusion is reached that "forests are a direct protection to the snow, those trees being most effective which allow the snow to reach the ground and yet protect it from the sun and wind. Fir trees have been found much superior to pine as conservers of snow, and forests with glades more satisfactory than continuous forests. Windbreaks on the lips of canyons and on exposed slopes are indispensable for holding the snow." The method of making estimates of stream flow based on the results of snow surveys is described.

Investigations on the relation of topography to the occurrence of frost in continuation of those previously reported (E. S. R., 27, p. 240) furnished data which "confirm earlier conclusions that, with elevation above the valley floor, there is a decrease both in the number of frosts and in the number of hours of orchard heating required, the decrease in the number of frosts with increase in elevation of 250 ft. in the Truckee Meadows having been found to be from 14 to 5 and in duration of freezing temperatures from at least 40 hours to 16. Also, except in abnormal years or in the coldest places, an average of two heatings each season will save the fruit. Moreover, it seems probable that at 28° F. or higher, except when the fruit is setting, no heating will be necessary to assure a moderate crop. . . . A simple rule has been devised for forecasting the probable maximum intensity of frost, namely, to subtract from the maximum temperature of the day on which the forecast is made the fall in temperature that normally occurs during the night when the weather is clear. In the spring at Reno this fall in temperature is 30 to 32°. Therefore, with a maximum temperature of 65° the minimum temperature should not be lower than 33°."

The studies on the effect of site and blossom development and frost injury are abstracted on page 40.

A method of forecasting the maximum summer level in Lake Tahoe from one to four months in advance, H. F. ALCIATORE (*U. S. Mo. Weather Rev., 44 (1916), No. 7, pp. 407–409*).—A proposed method which has been tested for two successive seasons with satisfactory results is based upon the inches of snow (melted) falling monthly from December to April at nine stations in the Truckee-Tahoe watershed (519 square miles). Tables are given showing the average cumulative snowfall of these months at the nine stations during six seasons and the average cumulative changes in the level of the lake from December to July, 1910–1915. The average change in level is found to be proportional within certain limits to the average snowfall. Knowing the variation of the actual snowfall from the average, it is easy to calculate the probable change in lake level.

"The results obtained in 1915, a season of light snowfall, and those for 1916, a season of heavy snowfall, indicate that the proposed method is practical, and that the estimates based on snowfall records for four stations are of practically the same degree of accuracy as those based on a larger number of records."

The persistence of wet and dry weather, E. V. NEWNHAM (*Quart. Jour. Roy. Met. Soc. [London], 42 (1916), No. 179, pp. 153–162, figs. 3; abs. in U. S. Mo. Weather Rev., 44 (1916), No. 7, p. 393*).—Analyzing the rainfall records of several British stations by modern statistical methods, the author reaches the conclusion "that during a long spell of wet weather there are no grounds for

expecting finer conditions merely because the unsettled weather has lasted so long; and similarly that during fine weather the chances of continued drought become greater the longer the fine weather lasts, at any rate for spells of a length commonly met with. What happens when the length of the spell reaches a quite abnormal value must remain doubtful, but it seems reasonable to suppose the probability reaches a constant value."

Monthly Weather Review (*U. S. Mo. Weather Rev., 44 (1916), Nos. 7, pp. 381–429, pls. 8, figs. 4; 8, pp. 431–498, pls. 29, figs. 18*).—In addition to weather forecasts, river and flood observations, and seismological reports for July and August, 1916; lists of additions to the Weather Bureau Library and of recent papers on meteorology and seismology; notes on the weather of the months; solar and sky radiation measurements at Washington, D. C., during July and August, 1916; condensed climatological summaries; and the usual climatological tables and charts, these numbers contain the following articles:

No. 7.—Initial Investigations in the Upper Air of Australia, by G. Taylor (abs.); Classification of the Hydrometeors, by G. Hellmann; The Variability of Temperature, by A. Angot; Weather Forecasting in the United States; The Persistence of Wet and Dry Weather, by E. V. Newnham (abs.) (see p. 18); New South Wales Rainfall (illus.), by D. J. Mares; "Act of God" defined; Hurricane of July 5, 1916, at Pensacola, Fla., by W. F. Reed, jr.; Hurricane of July 5–6, 1916, at Mobile, Ala., by A. Ashenberger; The Tropical Hurricane of July 5, 1916, in Louisiana, by I. M. Cline; South Carolina Hurricane of July 13–14, 1916 (illus.), by J. H. Scott; A Method of Forecasting the Maximum Summer Level in Lake Tahoe from One to Four Months in Advance, by H. F. Alciatore (see p. 18); and Annual Rise in the Columbia River, by F. D. Young (abs.).

No. 8.—High Haze over the Southwestern United States during July to September, 1916, by H. H. Kimball; Atmospheric Refraction at Mount Hamilton, Cal. (illus.); On the Abnormal Propagation of Sound Waves in the Atmosphere (illus.), by S. Fujiwhara (abs.); Auroras Observed during August, 1916; Distribution of Precipitation in China during the Typhoons of the Summer of 1911 (illus.), by Co-Ching Chu; Radiation Equilibrium and Atmospheric Radiation, by R. Emden (abs.); A Tornado in Utah, by A. W. Stevens; The Government Safety-first Train, 1916 (illus.), by R. H. Finch; Graphical Method of Showing the Daily Weather, by E. T. Quayle (abs.); Tower Cloud at San Juan, P. R., by F. E. Hartwell; Extensions of U. S. Weather Bureau Service; and The North Carolina Earthquake of August 26, 1916, by R. H. Finch.

The fertilizing value of rain and snow, F. T. Shutt (*Canada Expt. Farms Rpts. 1915, pp. 160–162*).—The data for the eighth year of this investigation (E. S. R., 33, p. 716), are reported. These are taken to indicate that "the amount of soluble nitrogen compounds that may serve as food for crops as furnished annually by the rain and snow is not large and can not be regarded as an important factor in adding to the soil's store of nitrogen. . . . Since this nitrogen is furnished in an immediately available form, chiefly during the growing season, the precipitation does act as a fertilizing agent of some value."

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. Ostrander and J. S. Sims (*Massachusetts Sta. Met. Buls. 333, 334 (1916), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during September and October, 1916, are presented. The data are briefly discussed in general notes on the weather of each month.

SOILS—FERTILIZERS.

Soil survey of Jefferson County, Arkansas, B. W. TILLMAN, R. R. BURN, W. B. COBB, C. LOUNSBURY, and G. G. STRICKLAND (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 39, fig. 1, map 1*).—This survey, made in cooperation with the Arkansas Experiment Station and issued September 25, 1916, deals with the soils of an area of 561,920 acres in southeast-central Arkansas, which comprises two general divisions, "an upland plain in the western part of the county and a lower river flood plain. The upland is prevailingly level, with small undulating to gently rolling areas. The lowland, or river bottom, section is a nearly level plain bordering the Arkansas River, with narrow extensions reaching into the upland along the smaller streams." "The drainage of much of the forested upland is deficient, owing to the level topography."

The soils are classed as upland or sedimentary soils and lowland alluvial soils. Twenty-two soil types of 10 series are mapped, of which the Portland clay and very fine sandy loam and the Caddo silt loam cover 17.8, 16.9, and 13.7 per cent of the area, respectively.

Kankakee County soils, C. G. HOPKINS, J. G. MOSIER, E. VAN ALSTINE, and F. W. GARRETT (*Illinois Sta. Soil Rpt. 13 (1916), pp. 72, pls. 2, figs. 10*).—This is the thirteenth of the Illinois county soil reports. Kankakee County is located in eastern Illinois and has been covered completely by the Illinoisan and the early Wisconsin glaciations.

The soils of the county are divided into upland prairie soils rich in organic matter, upland timber soils, terrace soils, late swamp and bottom land soils, and miscellaneous soil types. The brown silt loam prairie soils cover 35.74 per cent of the area, the brown sandy loam terrace soils 31.63 per cent, and the brown sandy loam prairie soils 13.12 per cent. "The variation among the different types of soil in Kankakee County with respect to their content of important plant food elements is very marked. The deep peat contains in the plowed soil of an acre thirty times as much nitrogen as the dune sand, and about five times as much nitrogen but only one-fifth as much potassium as the brown silt loam. The total supply of phosphorus in the surface soil varies from 560 lbs. per acre on the upland and 720 lbs. on the terrace, in the yellow-gray sandy loams, to 2,200 lbs. in the black clay loam terrace. The magnesium and calcium vary from about 3,000 or 4,000 lbs. in the lighter terrace soils to 15,000 or 20,000 lbs. in some other types. Some types contain an abundance of limestone, while others are practically neutral or slightly acid, and still others, such as the brown-gray silt loam on tight clay and the yellow-gray sandy loam (both terrace soils) and all upland timber soils, are distinctly acid in the surface, more strongly acid in the subsurface, and sometimes devoid of limestone even in the subsoil. More than 90 per cent of the soils of the county contain no limestone in the surface or subsurface to a depth of 20 in."

Reconnoissance soil survey of north part of north-central Wisconsin, W. J. GEIB, A. E. TAYLOR, L. R. SCHOENMANN, C. C. THOMPSON, T. J. DUNNEWALD, W. C. BOARDMAN, C. B. POST, and A. R. ALBERT (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 76, pls. 6, figs. 2, map 1*).—This survey, made in cooperation with the Wisconsin Geological and Natural History survey and issued September 15, 1916, deals with the soils of an area of 2,828,160 acres in north-central Wisconsin, the topographic features of which are characteristic of a glacial region. The surface varies from level to rolling and hilly. Including peat and rough stony land, 25 soil types of 9 series are mapped of which peat covers 20.4, Gloucester sandy loam 15.9, Spencer silt loam 15.1, and Gloucester fine sandy loam 13.9 per cent of the area.

Studies on soils, I, F. E. RICE (*Jour. Phys. Chem., 20 (1916), No. 3, pp. 214–227, fig. 1; abs. in Chem. Abs., 10 (1916), No. 11, p. 1568; Jour. Chem. Soc. [London], 110 (1916), No. 643, I, p. 360*).—Laboratory experiments conducted at the New York State College of Agriculture with a number of soils collected from various parts of New York are reported.

The results are taken to indicate that "when so-called 'acid' soils are shaken with salt solutions, part of the cation of the salt is adsorbed and an equivalent quantity of bases from the soil is given up to the solution. The extracts, thus obtained, show greater acidity than that of the salt solutions themselves. This can be accounted for by the fact that one of the bases present is aluminum, which does not securely hold its share of the acid, but through hydrolysis hydrated aluminum oxid is formed along with equivalent quantities of free acid. The former being slightly ionized, possibly in a colloidal condition, and the latter more or less strongly ionized, the resultant solution is quite acid.

"Acid soils rarely contain water-soluble acid; but one case of mineral soil and one of muck soil was found that did yield an acid to water. Basic soils (as distinguished from 'acid' soils) gave up to salt solutions more base than is adsorbed. But as they are also found to give up to water quantities of base sufficient to produce solutions of alkaline reaction, this should not be considered entirely a phenomenon of basic exchange, but of simple solution of the excess of base."

Studies on soil colloids, I, Flocculation of soil colloidal solutions, M. I. WOLKOFF (*Soil Sci., 1 (1916), No. 6, pp. 585–601, figs. 3*).—Experiments conducted at the Michigan Agricultural College to study the behavior of brick yard clay, silt loam soil, muck, peaty muck, and kaolin with respect to different electrolytes, in order better to understand the phenomenon of flocculation in the soil, are reported. Sixty-seven acid, salt, and alkali solutions were used in fifth-normal strength.

It was found that "besides the fact that the flocculating efficiency of different electrolytes with the same colloidal solution is different, the results show that the efficiency of the same electrolyte with the solutions from different soils varies considerably, depending largely upon the chemical composition of the soils. Schulze's valency law does not hold true with the soil colloidal solutions studied. Humic materials hinder the coagulating power of the electrolytes. It takes a greater amount of electrolyte for a flocculation of a more concentrated soil colloidal solution than that for a less concentrated one. In the flocculation of the soil colloidal solutions by the electrolyte, the reaction obeys, within the experimental error, the law of mass action."

Bacterial numbers in soils at different depths and in different seasons of the year, S. A. WAKSMAN (*Soil Sci., 1 (1916), No. 4, pp. 363–380, figs. 6*).—A brief review of the work of others bearing on the subject is followed by a report of experiments conducted at Rutgers College on the bacterial numbers in loam and clay loam soils.

It was found that "the greatest number of bacteria were at a depth of 1 in. in the soils that are under shade all the year round. Garden soil gave on the average the largest numbers 4 in. from the surface. There was a regular decrease in numbers of organisms from a depth of 1 in. . . . down to a depth of 30 in. The greatest decrease in numbers between any two consecutive depths of sampling occurred between the first and the fourth, or the fourth and the eighth inches. The meadow soil gave the largest bacterial counts at a depth of 1 in. of all the soils. . . . The forest soil, though showing a high carbon and nitrogen content, gave the lowest bacterial counts. . . .

"The numbers of bacteria in the soils studied were not governed either by the moisture content of the different soils or the nitrogen and carbon contents.

There was a gradual decrease in the lime requirement of the soils from the surface down to a depth of 30 in., except in the meadow soil. There was also a more or less gradual decrease in the nitrogen and carbon content of the different soils from the surface down to a depth of 30 in. . . .

"Frozen soil, though showing a high bacterial content, did not give the largest bacterial numbers through the year. . . . The time of maximum bacterial numbers during the year varied with the different soils throughout the year; no two soils showed their maximum bacterial content at the time of any one sampling."

A list of 30 references to literature bearing on the subject is appended.

Some factors that influence nitrate formation in acid soils, E. B. Fred and E. J. Graul (*Soil Sci., 1 (1916), No. 4, pp. 317–338, pl. 1*).—Experiments conducted at the Wisconsin Experiment Station with neutral silt loam, acid sand, acid silt loam, and acid peat soils are reported. "The following phases of nitrification were investigated: (1) A study of the occurrence of nitrate-forming bacteria in acid soils and their relation to the organisms commonly found in neutral soils, (2) a comparison of nitrification of organic and inorganic substances in acid and neutral soils, and (3) a comparison of the effect of calcium carbonate on ammonification and nitrification of organic substances. . . .

"It was found that the formation of ammonia from casein takes place so rapidly in acid soils that for several weeks after the nitrogenous substance is added the production of nitrates is not limited by lack of ammonia. The formation of nitrates in acid sand and acid peat takes place very slowly. In acid silt loam or the neutral silt loam nitrification takes place much more rapidly. The feeble nitrifying power of the sand and peat, as shown by inoculating these soils with an active culture of the nitrifying bacteria, is largely due to the condition of the soil. Apparently the nitrifying flora of silt loam when transferred to a neutral soil is as active in the formation of nitrates as the flora from silt loam.

"In the case of the acid soils it seems that the nature of the compound to be nitrified plays an important part. For example, in acid soils organic nitrogen nitrifies much more rapidly than nitrogen from ammonium sulphate. In nonacid soils the reverse is true—ammonium sulphate nitrifies more rapidly. This is true regardless of the source of the nitrifying bacteria.

"It seems that acid soils do not possess a strain of nitrifying bacteria especially resistant to soil acidity. In the presence of organic nitrogenous substances, as casein and gelatin, calcium carbonate did not permanently increase the accumulation of nitrates. For a short interval, one or two weeks, calcium carbonate stimulates nitrate formation; later the reverse is true and there is a decided decrease in the treated series. Apparently the reduction of nitrates is largely due to bacteria. It has been found that in the treated soil there is an enormous multiplication of the nitrate-assimilating bacteria. When stored under conditions that prevent leaching, all of the soils showed a gain in nitrate nitrogen. It seems that in silt loam nitrification increases soil acidity, and thus it becomes necessary to add a basic substance in order to keep the process going. . . .

"Considering the data as a whole, it seems that under laboratory conditions the beneficial effect of calcium carbonate on plant growth must be accounted for by some processes other than the direct effect on nitrification."

Studies in sulfofication, P. E. Brown and H. W. Johnson (*Soil Sci., 1 (1916), No. 4, pp. 339–362*).—Further experiments conducted at the Iowa Experiment Station along the lines of those previously noted (E. S. R., 34, p. 19), which were planned "to throw some light upon the problem of the relative

effects of gypsum, acid phosphate, rock phosphate, alone and with gypsum, and monocalcium phosphate on sulfofication, on ammonification, and on the yields of oats in pots in the greenhouse," are reported. The soil used was a loam, high in organic matter and having a basic reaction.

It was found that "the sulphate content of the soil varied only slightly from one sampling to the next. There were no sudden or striking changes in the amount of sulphates present in the soil kept fallow in the greenhouse. The sulphate content of soils in the field is subject to the same influences as the nitrate content, but the effects are probably much less pronounced.

"Calcium sulphate, monocalcium phosphate, acid phosphate, rock phosphate, and rock phosphate plus gypsum increased the sulfofying power of the soil. The sulphate alone and phosphates alone had greater effects than combinations of the two materials, as in acid phosphate. All the materials used increased the ammonifying power of the soil, but the differences between the effects of the various substances were not pronounced. The rock phosphate had less effect, however, than the other materials.

"The sulfofication tests and ammonification tests did not always run parallel, although very similar effects of the materials used on the two processes were noted. The phosphorus fertilizers, except monocalcium phosphate, increased the yield of oats, the acid phosphate to a greater extent than the rock phosphate. The sulphate had no effect on the crop yield. . . .

"The crop yields, sulfofication, and ammonification results were not always parallel. In general it appeared that on this soil increases in sulfofication were not necessarily parallel with increases in yields. The ammonification results were not conclusive, but indicate that materials supplying plant food constituents which are lacking in the soil may be of double value because of increases in the production of other plant food constituents in an available form."

Further experiments with a heavy black woodland soil, a typical river bank sand in sod, two humus soils, and a river terrace cornfield soil are also reported, the purpose of which was to ascertain whether the 10-day incubation period allowed the greatest differentiation between the sulfofying powers of soils from different sources and under varying treatments. "Shorter periods of incubation were eliminated . . . and the tests were carried out at 7, 10, 12, and 14 day periods." The effects of gypsum, calcium carbonate, and magnesium carbonate on sulfofication were also studied.

It was found that "in the use of the free-sulphur-fresh-soil method for testing the sulfofying power of soils the incubation period should be 14 days at room temperature to give the most conclusive results. Ten days' incubation gave the relative sulfofying powers of soils quite accurately, but the differences were much more distinctive for the longer period.

"Calcium sulphate in ordinary applications had no detrimental effect on sulfofication, but very large applications might decrease the rate of oxidation of sulphur. Calcium carbonate in ordinary applications on acid soils increased sulfofication considerably and even in excessive amounts affected sulphur oxidation favorably. Magnesium carbonate in small amounts increased sulfofication, but in large amounts depressed it even below that in the same soil with its acidity unneutralized. Magnesium carbonate and calcium carbonate in combination exerted a beneficial influence on sulfofication when used in small amounts. Larger applications, however, depressed the oxidation of sulphur. The effects of the combined material were less than those of the calcium carbonate alone."

Some effects of litter on the fermentation of manure, W. E. Tottingham (*Jour. Indus. and Engin. Chem., 8 (1916), No. 6, pp. 511–515, figs. 4*).—Experiments conducted at the Wisconsin Experiment Station on the chemical changes

in a fermenting mixture of manure and shavings, as compared with straw-littered manure and unlittered manure, are reported. A basal manure prepared by mixing one part by weight of fresh horse manure with two parts fresh cow manure and litters prepared by sifting finely cut oat straw, oak shavings, and Georgia pine shavings to uniform size, were used. Twenty-five lbs. of manure were mixed with 2 lbs. of litter.

It was found that "the loss of total organic matter during 12 weeks of fermentation ranged from 33 to 51 per cent. It was most rapid and greatest in the straw-littered manure, where bacteria were most numerous."

The water-soluble organic matter, ranging from 10 to 13 per cent of the total organic matter in the fresh manures, decreased continuously during 12 weeks of fermentation with the loss of from 60 to 80 per cent of the original amount, the loss being most rapid during the first two weeks. Humus ranging from 11.3 to 15.5 per cent of the total organic matter in the fresh manures decreased continuously, but more gradually than the water-soluble organic matter, during 12 weeks from 26 to 35 per cent. The losses from the littered manures were nearly equal and about one-third greater than from the control manure.

The water-soluble ash, ranging from 37.5 to 40.9 per cent of the total ash in the fresh manures, decreased gradually in all of the manures during 12 weeks of fermentation. The decrease ranged from 14 to 30 per cent of the amount originally soluble, being less in the straw-littered manure than in the other lots.

"The total nitrogen increased in all the manures until the fourth week of fermentation, the gains ranging from 8 per cent of the original amount in the control manure to 20 per cent in the straw-littered manure. More or less rapid loss of nitrogen occurred from the fourth to the eighth week of fermentation. After twelve weeks a net loss of nitrogen obtained in all of the manures. This net loss ranged from 3 to 13 per cent of the original amount of nitrogen, being less in the straw-littered manure than in the other manures.

"The water-soluble nitrogen decreased rapidly in all of the manures during the first four weeks. It suffered greater loss than any other constituent investigated, its curve being quite similar to that of the total organic matter. This constituent formed from 41.4 to 48.4 per cent of the total nitrogen at the beginning of the investigation. Losses of the water-soluble nitrogen ranged from 77 to 90 per cent of the original amounts and were somewhat greater in the shavings-littered manures than in the other lots.

"Humus nitrogen formed from 46.8 to 56.8 per cent of the total nitrogen in the fresh manures. Losses of this constituent ranged from 2 to 10 per cent of the original amounts, being greatest in the control manure. The fluctuation was similar in all of the manures, the humus nitrogen decreasing 10 to 20 per cent during the first four to eight weeks of fermentation and then gradually increasing.

"Ammoniacal nitrogen formed only 0.7 to 1.2 per cent of the total nitrogen at the beginning of the experiment. It rose to a maximum value in the control and shavings-littered manures during the first two weeks of fermentation, thereafter rapidly decreasing to about the original value after four weeks. In the straw-littered manure, on the other hand, the maximum production of ammonia was attained and passed gradually at about the fourth week. Ammoniacal nitrogen reached its greatest value in the control manure. In all cases, however, its values, ranging from 0.5 to 6.6 per cent of the total nitrogen, were too low to allow the placing of great importance on its fluctuations."

Fertilizer experiments, F. T. Shutt (*Canada Expt. Farms Rpts. 1915, pp. 95–110*).—A number of different fertilizer experiments begun in 1913 at Fred-

ericton, N. B., and Kentville, N. S., and in 1914 at Agassiz, B. C., are reported, from which the following conclusions are drawn:

"A judicious and rational use of fertilizers may in a very large number of instances, be depended upon to yield a profit. Injudiciously applied a monetary loss may result. With certain crops, especially potatoes and roots, the yield may be largely increased by fertilizers, frequently doubled. The proft obtained, over and above the cost of fertilizer, should always be calculated, and not merely the increase in yield noted. . . . In general, it is advisable to use a complete fertilizer. . . .

"Fertilizers give increases in crop yields on many types of soil; even those soils which are considered fairly rich frequently yield increases, though these increases may not in all cases show a profit after deducting the cost of the fertilizer. Large dressings of fertilizer do not necessarily mean large increases in yield or large net profits. In experiments with potatoes, the profitable application has seldom exceeded 400 lbs. per acre. . . .

"The manipulation of fertilizer formulas to meet the specific requirements of certain crops, as frequently practiced and advertised by fertilizer manufacturers is of little significance."

Protein decomposition in soils, E. C. Lathrop (*Soil Sci., 1 (1916), No. 6, pp. 509–532*).—Experiments to determine the changes taking place in dried blood in a fine sandy loam soil are reported.

"The ammonification of the dried blood in the soil during the first 86 days was very rapid, after which time the amount of ammonia produced and the rate of ammonification decreased markedly until the end of the experiment. At the end of the experiment the rate of transformation of hydrolyzable nitrogen into ammonia nitrogen in the soil was but about 10 per cent of the rate observed after the decomposition had been proceeding for 18 days. During the 240 days of the experiment 79 per cent or more of the nitrogen of the dried blood proteins was converted into ammonia nitrogen.

"The ammonia produced during the decomposition of the dried blood was derived from (1) the hydrolytic cleavage of the proteins of the dried blood, as evidenced by the rapid vanishing of the amid compounds from the soil during the first five days of the experiment; and (2) from the decomposition by the micro-organisms of the products resulting from the hydrolytic cleavage of the proteins. . . . With the exception of the amid compounds, lysin seems to have disappeared most rapidly and completely from the soil. The monoamino acids contributed about 89 per cent of their nitrogen to the formation of ammonia, and arginin and histidin each contributed about 83 per cent.

An analysis of the figures obtained by the Van Slyke method points to the generation of new protein materials in the soil. This is indicated by (1) the unequal loss of monoamino acids and hydrolyzable nitrogen from the soil during the early stages, (2) by an increase in amid nitrogen during the early stages, (3) by an increase in histodin nitrogen during the early stages, (4) by an increase in arginin nitrogen during the later stages, and (5) by an increase in lysin nitrogen during the later stages. This new form of protein seems to be more resistant to the action of the micro-organisms than were the proteins of the dried blood, since the amid compounds of the dried blood vanished very largely from the soil in five days, but the amid compounds produced in the soil decreased only to the extent of 57 per cent during the remaining 222 days of the experiment, and also since the lysin of the dried blood almost entirely disappeared from the soils during the first 86 days of the experiment, but during the last 154 days of the experiment a continual increase in this form of nitrogen was observed.

"Protein-like substances, nonextractable by distilled water but extractable by 1 per cent sodium hydroxid solution, were isolated from the soil after the dried blood had decomposed for 240 days."

A list of 60 references to literature bearing on the subject is appended.

Potash salts, 1915, W. C. Phalen (*U. S. Geol. Survey, Mineral Resources of the United States, 1915, pt. 2, pp. 95–133*).—This bulletin gives a general review of domestic conditions with reference to the production and sources of potash, together with a brief description of processes involved in production, and simple tests for potash by W. B. Hicks.

It is stated that in 1915 soluble potash salts were produced in this country valued at $342,000. "By-product potash from cement manufacture has become a reality at Riverside, Cal. Potassium sulphate from alunite was first placed on the market late in October, 1915, at Marysvale, Utah. An important production of potash salts is announced from Jesse Lake, near Hoffland, western Nebraska. Some potash was marketed in the form of dried kelp, which, however, must be considered of organic rather than mineral origin. Without much doubt, potash salts were produced in small quantity from feldspar or other silicate rocks and incorporated into mixed fertilizers without intermediate refinement. . . .

"Active operations are in progress in California at Searles Lake and at Keeler, on the shore of Owens Lake, and the by-product bittern at the solar evaporation plants on San Francisco Bay has also received some attention. In Utah, near Great Salt Lake, as is reported, one company is erecting a plant and another plant will soon be begun at the south end of the lake. An additional plant is also planned for Marysvale for work on alunite. . . .

"The imports of refined potash salts (all from Germany), which include the 80 per cent chlorid used in agriculture, were about one-fourth in 1915 what they were in 1913, the last normal year, and the imports of kainit and manure salts were about 3 per cent of those in 1913. All the imports of potash salts taken together amounted in 1915 to about one-tenth of recent imports under normal conditions."

Attention is also drawn to what appear to be promising foreign potash deposits in Spain and Chile.

A bibliography of 56 works bearing on the subject is appended.

The oxidation of sulphur in soils as a means of increasing the availability of mineral phosphates, J. G. Lipman, H. C. McLean, and H. C. Lint (*Soil Sci., 1 (1916), No. 6, pp. 533–539*).—Experiments conducted at the New Jersey Experiment Stations with pure sea sand, tenacious red silt loam, and medium loam soil to determine the influence of sulphur oxidation on the availability of rock phosphate are reported. Five gm. of sulphur and 15 gm. of rock phosphate were added to 100-gm. quantities of the soils.

It was found that "elementary sulphur is readily oxidized in soils containing sulfofying bacteria and offering favorable conditions for the development of these organisms. The oxidation of sulphur in soils may lead to the accumulation of large quantities of sulphuric acid. The sulphuric acid formed in the oxidation of sulphur by bacteria readily reacts with basic substances. Tricalcic phosphate, when added to soils or soil mixtures in which sulfofication is active, may react with the sulphuric acid formed, and may then furnish available phosphoric acid to crops. The facts recorded above justify the claim that compost heaps in which sulfofication is active may be utilized for the production of available phosphoric acid out of insoluble phosphates."

The influence of liming on the productiveness of certain soils, F. T. Shutt (*Canada Expt. Farms Rpts. 1915, pp. 110–115*).—Chemical analyses of acid soil from Cap Rouge, Quebec, are reported, the results of which are taken to indicate

that the soil is relatively rich in the essential elements of fertility but markedly deficient in lime. Plat experiments with barley, oats, wheat, peas, and roots showed that liming at the rate of two tons per acre was markedly beneficial to barley and peas, and slightly beneficial to oats, wheat, and roots.

Fertilizing materials, F. T. SHUTT (*Canada Expt. Farms Rpts. 1915, pp. 115–127*).—Analyses of limestones, crushed clam shells, marls, wood ashes, mucks, peats, river and tidal muds, and certain by-products from manufacturing processes, are reported.

AGRICULTURAL BOTANY.

Agriculture and native vegetation in Peru, O. F. COOK (*Jour. Wash. Acad. Sci., 6 (1916), No. 10, pp. 284–293, figs. 2*).—Opportunity for studying the relations of agriculture to forest vegetation in southern Peru and Bolivia having been afforded, the author has given an account of the biological conditions favoring forest growth, the present and former forest flora in the Andes, the habits of surviving native trees, the influence of forest fires, and the agricultural habits of the people.

The vegetation of a desert mountain range as conditioned by climatic factors, F. SHREVE (*Carnegie Inst. Washington Pub. 217 (1915), pp. 112, pls. 37, figs. 18*).—Results are given of a study covering several years of the ecology of the Santa Catalina Mountains, near Tucson, Ariz. The author recognizes three prominent divisions, desert, semidesert or shrub, and forest regions. The vegetation of each region is described, and an attempt is made to correlate the plant life with the climatic factors, which were carefully determined.

Characters of plants grown in salt water and heredity, P. LESAGE (*Rev. Gén. Bot., 28 (1916), No. 326, pp. 33–44*).—The author carried on a series of experiments during 1911 to 1915 to determine whether the differences observable between *Lepidium sativum* grown in surface water and that grown in sea water or weaker concentrations of salts are persistent and hereditary.

It is stated that of the various modifications produced in the specimens grown in salt water, so far as yet studied, only three (admittedly correlatives) appear to show a tendency to persist, namely, decreased size, diminished proportion of large seeds, and diminution of the average size of the seeds.

Note on an orderly dissimilarity in inheritance from different parts of a plant, W. BATESON and CAROLINE PELLEW (*Proc. Roy. Soc.* [*London*], *Ser. B, 89 (1916), No. B 612, pp. 174, 175*).—Reporting a continuance of studies previously noted (E. S. R., 34, p. 41), the authors state that they have followed up the suggestion given by the fact that in the intermediate forms previously described the characters may change progressively with growth, the lower parts being more typelike, the upper more roguelike, while only the lowest leaves of the F_1 plants show any influence of the type parent. These observations suggest that when the offspring consists of a mixture of types and rogues, the types may be derived from the lower, and the rogues from the upper, parts.

Having in 1915 saved the upper and the lower pods separately from many pea plants, the bulk of which were reserved for further tests, the authors made a preliminary trial with a few seeds. As a result, it is thought that a segregation takes place in the soma of the plant such that the type elements are present especially in the lower parts, as had been surmised from the F_1 generation. It is, therefore, considered probable that the rogues which are derived directly from typical plants are derived predominantly from the apical pods.

A hybrid between Tripsacum and Euchlæna, G. N. COLLINS and J. H. KEMPTON (*Jour. Wash. Acad. Sci., 4 (1914), No. 5, pp. 114–117*).—It is stated that in studying the heredity of maize and related plants, a fertile hybrid be-

tween *E. mexicana* and *T. dactyloides* has been secured, previous attempts having always given negative results, though Euchlæna freely hybridizes with maize.

Of the four hybrid seeds planted April 8, 1913, only one germinated. The seedling was found to resemble the male parent, *E. mexicana*, in practically all discernible characters, and this resemblance continued throughout the life of the plant. This plant is regarded as remarkable on account of the profound morphological differences between the parents (one of which is moreover strictly annual, the other perennial, requiring several years to mature), and the completely patroclinous characters of the hybrid.

Patrogenesis, a form of inheritance with the characters of the female parent completely excluded—a cross between two genera of grasses, Tripsacum and Euchlæna, G. N. Collins and J. H. Kempton (*Jour. Heredity, 7 (1916), No. 3, pp. 106–118, figs. 8*).—The one patroclinous hybrid reported above was grown from a Tripsacum seed to maturity in the greenhouse, carefully guarded, and self-pollinated, producing a quantity of seed. The first generation plants were pollinated from a Florida Euchlæna and from two very late varieties of tropical corn, all these pollinations being successful. A few seeds representing the results of each class of pollinations were planted in the greenhouse in December, 1913, but gave only 7 plants, one of which failed as a result of structural abnormalities which are described. During the early stages, the remaining 6 plants behaved much as did the first generation plant, but later differences developed in some cases, which are described. Further plantings (from the original lots of seed from the first generation plant), transplanted to the open or made directly in open soil, developed no abnormalities.

In 1915, experiments were conducted near San Diego, Cal., the long growing season affording the first opportunity for the hybrid to mature undisturbed. It is stated that the crosses between Tripsacum and Zea showed usually complete resemblance to the female parent, and it is thought possible that Zea pollen may have induced parthenogenesis in the Tripsacum plant. Studies to test this hypothesis have been instituted.

In attempting to explain the fact that a cross between *E. mexicana*, male, and *T. dactyloides*, female, has been carried over three generations without exhibiting any characteristics of the female parent, it is thought that two hypotheses may be presented, namely, that the characters of the female parent have been completely masked by those of the male, or that the male nucleus developed in the ovary to the complete exclusion of the female, representing in a way the counterpart of parthenogenesis. The observed facts and circumstances are thought to exclude the first hypothesis. If the second alternative be adopted, we are compelled, the authors hold, to look upon the results of the cross as a special type of inheritance not previously recognized. No true hybridization or conjugation between the two nuclei appears to have taken place. The term patrogenesis is proposed as appropriate in such cases, also as serving to place this phenomenon in proper contrast with parthenogenesis. This is considered to have been rendered appropriate by the occurrence of what appears to be true parthenogenesis in Tripsacum when pollinated with maize.

Studies on the influence of temperature on the growth of the root of Pisum sativum, Isabella Leitch (*Overs. K. Danske Vidensk. Selsk. Fordhandl., No. 2 (1916), pp. 109–112*).—Experiments are reported on the growth of the roots of peas at various temperatures. The minimum temperature for growth was found to be —2°, the maximum 42.5° and the optimum 29° C. The maximum amount of growth for a very limited time occurred at 30.3°.

The influence of temperature variations on the respiration of plants, L. Blanc (*Rev. Gén. Bot., 28 (1916), No. 327, pp. 65–79*).—The author has

tested the relations between changes in respiration as noted in embryos of *Phaseolus vulgaris*, etiolated stems of *Vicia faba*, and young leaves of *Secale cereale* as related to different temperatures and to changes of temperature, either gradual or more or less abrupt, and to restoration of former temperatures.

It is stated that sudden variations of temperature do not of themselves constitute an excitant as regards respiration in plants. Between the respiratory activity corresponding to a given temperature and that corresponding to a different temperature the transition is gradual, and the course of respiration change corresponds to that of temperature.

The decrease of permeability produced by anesthetics, W. J. V. OSTERHOUT (*Bot. Gaz., 61 (1916), No. 2, pp. 148–158, figs. 6*).—The present paper gives details, with discussion, of some experiments previously reported (E. S. R., 28, p. 732) and of later researches on tissues of *Laminaria saccharina*, as regards their electrical conductivity under the influence of photosynthesis.

It is stated that increase of permeability (except in case of alcohol within certain limits) corresponds to a permanent injury and is not reversible. It is not, therefore, to be regarded as a characteristic effect of the anesthetic. The characteristic effect of anesthetics is regarded as being connected in some way with decrease of permeability. It is stated that a decrease of permeability may result in the decrease of irritability, which is the characteristic effect of an anesthetic.

Swelling and germination of seeds, J. TRAUBE and T. MARUSAWA (*Internat. Ztschr. Phys. Chem. Biol., 2 (1915), No. 4–5, pp. 370–393*).—It is stated that the behavior of starchy seeds in relation to electrolytes and nonelectrolytes as described corresponds essentially to that of starch.

Swelling and differences therein are more considerable in case of such nitrogenous legumes as peas than in such cereals as barley. Narcotics retard swelling, presumably on account of their flocculating effect on nitrogenous material. The fact that acids and also indifferent narcotics retard swelling of plant seeds is thought to indicate that swelling does not play the principal part in germination. Indifferent narcotics cause more commonly a genuine narcosis, but in some cases they cause irreversible injury. Acids still more often give the latter result, the law of mass action possibly applying here to colloidal phenomena. Some fatty acids appear particularly injurious. In certain low concentrations citric acid greatly hastens germination of seeds. No constant relation was noted between injury to germination and growth.

The influence of oxygenated water on germination, E. DEMOUSSY (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 12, pp. 435–438*).—Reporting a study of the kind of influence exerted by oxygen in favoring the germination of aged seeds, the author states that 7-year-old seeds of garden cress which failed to germinate when partly immersed in distilled water gave germination rates of from 30 to 40 per cent in water containing oxygen, the time required for germination being from three to ten days. The oxygen is thought to have retarded the development of micro-organisms which find partial or total protection from antiseptics in mucilagenous layers of the seeds. The oxygenated water was ineffective at low temperatures. Seed which failed to germinate in pure water at 27° C. gave a germination rate of 25 per cent in moist sand at that temperature, a result attributed to the increased access of oxygen.

Studies on water transfer in plants, L. JOST (*Ztschr. Bot., 8 (1916), No. 1, pp. 1–55, figs. 12*).—It is stated that the cut stump of a plant gives up much less water than is taken up at first by the portion which has been cut away when this is placed in water, or than the intact leaf requires. The cause of this alteration is thought to lie in the interruption of the connections in the tracheal

tissue, and the failure of negative pressure is the cause of the decrease or cessation of withdrawal of water from the root. Higher negative pressures give a greater flow than lower, but the increase does not bear a simple proportion to the change in pressure. The flow from the cut stump may be greatly weakened in spite of increased negative pressure by cooling the lower part or immersing it in water or hydrogen.

The separated top, immediately and for a while after its separation, shows a considerable increase of water uptake, indicating that tensions exist in the intact plant. These afterwards reach a state of equilibrium in connection with the atmospheric pressure on the cut surfaces and the attainment of a uniform inflow of water, which some plants maintain for some time under constant temperature.

Studies on the decomposition of cellulose in soils, I. G. McBeth (*Soil Sci., 1 (1916), No. 5, pp. 437–487*).—This paper deals mainly with bacteria which dissolve cellulose, a considerable number of which were found in the 69 soils of southern California examined by the author. In working out descriptions of new species, a number of which are systematically discussed, an attempt is made to bring out individual characteristics as concisely as possible. A summary is given of the more important morphological and cultural features of the bacteria.

The cellulose agar plate method is said to be the most satisfactory for isolating pure strains of bacteria, filamentous fungi, and Actinomycetes, which dissolve cellulose and all of which grow under anaerobic, but much better under aerobic, conditions. Filamentous fungi are thought to play a much more important part in cellulose destruction in the humid soils of the eastern part of the United States than in the semiarid soils of southern California, where the rapid destruction of cellulose is thought to be due to favorable climatic and cultural conditions rather than to the unusual activity of the cellulose-dissolving soil flora.

The primary sugar of photosynthesis, H. H. Dixon and T. G. Mason (*Nature [London], 97 (1916), No. 2425, p. 160*).—It is stated that while microchemical tests on the assimilating cells of certain plants indicate a considerable concentration of hexoses in the chloroplasts or in the protoplasm immediately surrounding them, other lines of experiment suggest that while sucrose is concentrated in the large vacuoles invertase is held apart from it in the protoplasm.

The view that the formation of sucrose is a preliminary step in the production of hexoses in the leaf is not considered a necessary deduction from the work of some other investigators named. It is thought more probable that the hexoses are formed from formaldehyde in the chloroplast, and that at a certain concentration condensation into sucrose takes place due to invertase or some saccharogenic enzym, the sucrose thus formed being passed into the vacuole and stored there. The volume of the protoplasm available for the hexoses being small as compared with that available for sucrose, the increase in the total percentage of the hexoses formed will be relatively small on exposure of the leaf to light as compared with the increase in sucrose. This is therefore regarded as insufficient proof of sucrose being the primary sugar. The recognition of the localization of the various substances in the cell is considered to furnish an explanation as to how the sucrose-hexose ratio of the cell is maintained in the presence of invertase.

The biochemical function of magnesium in plants, L. Bernardini (*Ann. R. Scuola Sup. Agr. Portici, 2. ser., 12 (1914), pp. 361–389*).—It is thought that magnesium in connection with calcium plays an important part in the process of vegetative growth in relation to the assimilation of phosphoric acid and in

the transportation of phosphorus to the growing and maturing seeds. The same is thought to be true in the alimentation of the embryo and the nutrition of very young shoots, in which magnesium seems to serve as a vehicle for the transfer of phosphoric acid. Certain observations are thought to indicate the necessity for the presence of magnesium in the shoots in connection with the formation of chlorophyll.

The influence of various salts on the growth of soy beans, J. W. SHIVE (*Soil Sci., 1 (1916), No. 2, pp. 163–170, fig. 1*).—As a result of experiments to test the influence of various salts on the growth of *Glycine hispida* and *Solanum nigrum*, employing the same pots of soil in the same way, it was found that the seeds of the latter failed to germinate and that germination and growth of the former were greatly impaired. These experiments, which are described, are regarded as suggestive but not conclusive.

Studies in the nutritive relations of our cultivated plants, L. HILTNER, G. GENTNER, and K. MAISCH (*Landw. Jahrb. Bayern, 3 (1913), No. 10, pp. 485–583, figs. 10*).—This contains an account of a study by these authors on the growth of plants in nutritive solutions, and of another by the first two authors named on the influence of humus in plant nutrition.

Diastase activity and invertase activity of bacteria, G. P. KOCH (*Soil Sci., 1 (1916), No. 2, pp. 179–196, figs. 4*).—The author states that enzyms determined as diastase and invertase are secreted by bacteria in culture solutions in determinable quantity. Enzyms secreted by bacteria in different solutions show considerable differences in their activity, which also varies from day to day.

Bacteria appear to produce a factor which may prevent starch hydrolysis and sucrose inversion. There seems to be no direct correlation between hydrolytic enzym secretion and protein decomposition, but a correlation appears to be possible between the utilization of protein decomposition determined as ammonia and the formation of acid. Enzym activity varies considerably with different species of bacteria and also with different cultures of the same species. No correlation was found to exist between hydrolytic enzym secretion and the rotation of polarized light, the percentage of reducing compounds, the formation of acid, and the number of organisms. Bacteria may increase or may decrease the rotary power of the solution, but do not produce in the solution a surplus of reducing compounds. There is an increase in bacterial numbers up to the third day, after which *Bacillus coli* shows irregularity, while *Bacterium mycoides* shows a decrease.

Quantitative media for the estimation of bacteria in soils, R. C. COOK (*Soil Sci., 1 (1916), No. 2, pp. 153–161*).—An account is given of experiments as carried out with different media and soils.

It is concluded that sodium asparaginate agar, albumin agar, and urea ammonium nitrate agar will usually give a greater colony development than other media now in use for bacteriological work. Albumin agar in which the albumin is dissolved in sodium hydroxid is said to give results more consistent than those obtained with albumin in water solution. Considerably higher bacterial counts were obtained from a five-day than from a three-day incubation period. Equally good results as regards sterilization were obtained from flowing steam or steam standing under a pressure of one atmosphere. Differentiation in blood meal and hay infusion agars was marked. The behavior of some soils toward the several media may vary as regards both degree and direction of the influence exerted in the comparative tests.

A method for the renewal of plant nutrients in sand cultures, A. G. MCCALL (*Ohio Jour. Sci., 16 (1916), No. 3, pp. 101–103, fig. 1*).—The author describes a method which he has devised by which it is claimed that seedlings may be

grown in sand and the nutrient solution kept constant, renewed, or modified almost as readily as in water cultures.

Preliminary revision of the genus Inga, H. Pittier (*U. S. Nat. Mus., Contrib. Nat. Herbarium, 18 (1916), pt. 5, pp. 173–223+XI, pls. 25*).—A preliminary revision of the genus Inga, many of the species of which are important leguminous trees, is given. A considerable number of new species are described.

FIELD CROPS.

[Field crops work at the Canada stations and farms in 1914, J. H. Grisdale et al. (*Canada Expt. Farms Rpts. 1915, pp. 618, 619, 673, 674, 692–694, 703, 736–741, 747, 751, 760–762, 773, 774, 787, 788, 796, 801–803, 813, 814, 841, 847, 854, 855, 867–947, 1015–1100, 1153–1191, 1193–1210, pls. 7*).—A report of the continuation of work previously noted (E. S. R., 33, p. 728) and a detailed account of work already mentioned (E. S. R., 33, p. 34), including mainly variety and cultural tests with grain and forage crops, flax, potatoes, and tobacco.

Variety and cultural tests were conducted with winter and spring wheat, emmer, spelt, oats, barley, winter and spring rye, peas, beans, flax, and buckwheat at the experiment stations, substations, and farms in Ontario, Prince Edward Island, Nova Scotia, Quebec, Manitoba, Saskatchewan, Alberta, and British Columbia. The results obtained are presented in tables with brief comments. Similar work in the same localities with forage crops included tests of corn for grain and silage, peas and oats for forage, timothy and clover for hay and for seed, grass and clover mixtures, vetches, orchard grass, western rye grass, red fescue, redtop, awnless brome grass, and other grasses, annual hay crops including different kinds of millet, alfalfa, sainfoin, clovers, turnips, mangolds, carrots, and sugar beets.

Results of variety and culture tests with tobacco and of observations on seed bed management conducted in the Provinces of Ontario and Quebec are reported in tabular form and described, and notes are given on the harvesting and curing and on the different varieties entering into the trials. The work on seed bed management has been noted from another source (E. S. R., 35, p. 233). In a fertilizer experiment the maximum yields of 1,537 lbs. each per acre were obtained on plats receiving 250 lbs. of sulphate of ammonia, 180 lbs. of sulphate of potash, and 100 lbs. of superphosphate; and 250 lbs. of sulphate of ammonia, 150 lbs. of sulphate of potash, and 80 lbs. of superphosphate per acre. It is concluded that nitrogen and potash are the important elements and that only a comparatively small quantity of phosphoric acid is required on the soils under test.

The nicotine content of the different varieties of tobacco under experiment, as determined at the tobacco station at Farnham, Quebec, is reported in a table, together with the results of soil analyses for the different plats on which the tobacco was grown. The tobacco station at Harrow, Ontario, tested rye, hairy vetch, and clover as cover crops in connection with tobacco culture, and studied the use of fertilizers and the value of soil disinfection in seed bed management. A combination of nitrate of soda, sulphate of potash, and superphosphate mixed in equal proportions by weight and applied at the rate of 0.1 of a lb. per square foot gave excellent results as a plant-bed fertilizer. Sowing Burley beds on the same area for more than one or two years was found unsatisfactory unless the soil had been changed or sterilized. A cold bed with glass covering gave plants about ten days earlier than a cold bed with cotton covering. A test carried on at Walkerville, Ontario, gave no conclusive evidence in favor of the use of acid phosphate as a means of controlling root rot.

A report on the status of the tobacco industry in the different tobacco producing sections of Ontario is presented.

[Work with field crops at the Canada experimental farms in 1914], W. L. GRAHAM ET AL. (*Canada Expt. Farms Rpts. 1915, pp. 171-349, 355, pls. 9*).—A summary of the results here reported has been noted from another source (E. S. R., 33, p. 830).

Summary report of state experiment farms and cooperative experiment farms, 1915, (*Cheyenne, Wyo.: State Bd. Farm Comrs., 1915, pp. 70, pl. 1*).—Notes are given on the cultivation of flax and cereal and forage crops at Archer, Jireh, and Sheridan with only the natural rainfall, and at Lyman, Eden, and Torrington with irrigation.

Cereal experiments at the Akron field station, Akron, Colorado, G. A. McMURDO (*U. S. Dept. Agr. Bul. 402 (1916), pp. 34, figs. 11*).—This bulletin describes the topography, soil, and climate of the district in which the field station is located and presents in tabular form with discussions the results of tests with 17 varieties and strains of winter wheat, 44 of spring wheat, 16 of oats, and 19 of barley, conducted from 1908 to 1915, inclusive. Rye, emmer, flax, proso, and grain sorghums were also tested but on a smaller scale.

Winter wheat gave better results than spring wheat and the durum wheats produced higher average yields than the common spring wheats. Crimean winter wheat produced the highest average yield, 22 bu. per acre, of any winter wheat tested during the eight years and Kharkof ranked second with 21.6 bu. The highest average yield of any spring wheat obtained in the eight years, 22.4 bu. per acre, was produced by Pelissier, a durum wheat, followed by Velvet Don with an average yield of 21.5 bu. and Arnautka with 21.1 bu. Ghirka spring wheat, of the Fife group, yielded 18.6 bu. Tests in seeding winter wheat at different rates were not satisfactory but it is believed that 3 pk. per acre is the best rate. Date-of-seeding tests indicated that the period from September 15 to October 15 is the best for sowing winter wheat. Tests with spring wheat indicated that sowing from 3 to 4 pk. per acre is likely to give the best yields.

The best varieties of oats tested for the eight years were Kherson, an early variety, with an average yield per acre of 44.7 bu. and Colorado No. 37, a midseason variety, with a yield of 43.9 bu. The late varieties yielded much less than the early or midseason sorts. A comparison of different rates of seeding of Kherson oats indicated that the best yields are obtained by sowing 4 pk. per acre.

The best varieties of barley compared during the 8-year period were Hannchen, giving an average yield of 38.7 bu., and Coast, yielding 38 bu. The 2-rowed group of barleys gave higher average yields than the 6-rowed group.

Winter rye proved inferior in value to wheat. Winter emmer was not hardy and gave an 8-year average yield of 14.2 bu., while White spring emmer averaged 30.3 bu. per acre. Flax did not compete successfully with weeds, and most varieties of grain sorghums failed to mature. The 5-year average yield of Manchu Brown kaoliang was 15.4 bu. per acre, and the average yield of proso for the same period was 23.1 bu. Proso seemed to be valuable mainly as a catch crop.

Cereal experiments at the Judith Basin substation, Moccasin, Montana, N. C. DONALDSON (*U. S. Dept. Agr. Bul. 398 (1916), pp. 41, figs. 17*).—This bulletin is a report on experiments with cereals conducted cooperatively since 1908 by the Office of Cereal Investigations of the U. S. Department of Agriculture and the Montana Experiment Station. In addition to the tabulated results of experiments with wheat, oats, barley, and flax and their discussion, descriptions are given of the Judith Basin, mainly with reference to topography

and climate, and of the substation located there. The altitude of the locality is given as 4,300 ft. The annual average precipitation at Moccasin from 1898 to 1915, inclusive, was 16.66 in., and the average seasonal rainfall from April to July, inclusive, for the same years, 9.41.

The leading varieties of the different cereals grown in the experiments are compared in the following table:

Annual and average yields and average farm value of the leading variety of each of the cereals grown at the Judith Basin substation.

Crop and variety.	Yield per acre.						Acre value of crop
	1910.	1911.	1913.	1914.	1915.	Average.	
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
Kharkof winter wheat	2,880	2,478	1,866	1,470	2,964	2,331	$31.08
Pelissier spring wheat	630	1,698	1,920	1,590	2,530	1,673	21.58
Sixty-day oat	1,056	2,278	2,409	1,888	2,998	2,126	23.70
White Smyrna barley	590	2,490	3,360	2,400	3,854	2,540	28.42
Nepal barley	984	1,800	2,220	1,542	2,508	1,810	18.24
Russian flax	......	1,070	930	728	1,282	1,002	27.09

The results of the experiments were in favor of sowing winter wheat at the rate of 3 pk. per acre and of the period from August 10 to September 10 as the best time for sowing. The highest yields of spring wheats were obtained from varieties of durum wheat, of which Pelissier was the best producer. Marquis was the leading variety of the common spring wheats. With reference to the time of sowing, the best results were obtained from sowing all spring wheat, oats, and barley as early in the spring as soil and climatic conditions permitted. Sowing flax between April 15 and May 1 is considered as being probably most satisfactory. The quantity of seed per acre recommended for spring wheat and small-kerneled, early varieties of oats, such as Sixty-Day, is 4 pk.; for hulled varieties of barley 5 pk.; naked varieties of barley 4 pk.; and flax 20 to 25 lbs. Sixty-Day oats averaged about 16 bu. per acre more than later maturing varieties.

Emmer and spelt did not give so good yields as barley and oats, and proso millet did not prove promising. Early varieties of brown kaoliang and broom corn did not mature seed.

A pasture survey in southeastern Ohio, H. W. Hawthorne and C. W. Montgomery (*Mo. Bul. Ohio Sta., 1 (1916), No. 9, pp. 282-288, figs. 2*).—This article deals with a survey of the pasture conditions in eastern and southeastern Ohio, made in 1913 in cooperation with the Office of Farm Management of the U. S. Department of Agriculture. Information was gathered through correspondence and conferences with a number of farmers.

The pastures were designated as rotation pastures and permanent pastures. The prevalent rotation was corn, oats, and wheat, with the wheat sown to red clover and timothy, and maintained as pasture from one to nine years, during which fertility was kept up chiefly through the use of commercial fertilizers on the preceding crop. Most of the permanent pastures were not seeded for that special purpose, although in some cases mixtures of timothy, orchard grass, blue grass, and clovers were used. Fertility was maintained in a few instances by top-dressing with commercial fertilizers or manure. One farm reported the clipping of the stubble each year after harvesting, which resulted in thickening the sod and increasing the carrying capacity of the fields.

An irrigation experiment with clover, sugar beets, potatoes, and wheat, C. S. KNIGHT (*Nevada Sta. Rpt. 1915, pp. 24-28*).—This experiment was conducted in 1914 on soil varying from a sandy loam to a clay loam. In the irrigation of clover 6, 9, and 12 inch applications were made at various stages of wilting. The results showed that clover can not be allowed to reach the wilting stages without materially decreasing the yield of hay, and that on soils such as that of the experiment applications of from 9 to 12 in. given before the plants show need of water are essential for the heaviest production.

Potatoes were given 3, 6, and 9 inch applications of water before and at the time the plants showed a tendency to wilt, when all leaves wilted down once, and when all plants failed to revive at night. Where the plants were allowed to wilt to the extent where they failed to revive at night it was found impossible to produce a satisfactory crop. The highest yields were produced with the smallest application of water, although little difference was shown in yield where the crop received two, four, or five 3-inch applications. The highest starch content was secured with the smallest applications when the plants were never allowed to wilt, and in the three stages of wilting the highest starch content was obtained with the largest applications.

An experiment similar to the one with potatoes was conducted with sugar beets with the exception that 2, 4, and 6 inch applications of water were made. Where no irrigation was given until the plants wilted down and failed to revive at night, an unsatisfactory crop was produced. With 2-inch applications the beets in all stages of wilting showed a higher sugar content than those receiving the greater amounts of water. The purity of the sugar was greatest in the beets irrigated only after all plants had wilted down once.

Wheat was given 3, 4½, and 6-inch applications of irrigation water at the five-leaf, boot, bloom, milk, and dough stages. A comparison was made of plants receiving an irrigation at each of the five stages, with plants in which an irrigation was omitted in each of the five stages, with plants in which irrigation was omitted at any two of the five stages, and with those that received the same amount of water in only two applications—one before and one after heading. Where one irrigation was omitted, the omission of the application at the five-leaf stage gave the best results, with a difference in yield of less than 3 per cent in the three highest producers. Where two irrigations were omitted satisfactory results were noted only where the irrigations were omitted at the five-leaf and dough stages. Four 6-inch irrigations with one application omitted at the five-leaf stage yielded 25.8 per cent more than five 6-inch applications. Omission of irrigations between the boot and milk stages greatly decreased the yield of grain. With only two irrigations the 6- and 12-inch applications proved most satisfactory. Of the results in yield 83 per cent were in favor of the 6-inch applications, the difference being greatest where two irrigations were omitted at the five-leaf and dough stages.

The different depths affected the soil moisture only to a slight extent when two irrigations were omitted, but when only one irrigation was passed over an average difference of 12.3 per cent was noted in the first 3 ft. in favor of the 6-inch application. In the first 2 ft. with 6-inch applications the average soil moisture content before irrigation at the milk stage was 20 per cent less where two irrigations were omitted than where only one irrigation was omitted.

The average nitrogen content of the plants for all plats at the different stages of growth is given as follows: Five-leaf 4.37 per cent, boot 2.75 per cent, bloom 2.09 per cent, milk 1.4 per cent, and dough 1.25 per cent.

An investigation of varieties of cereal and forage crops and their improvement, C. S. Knight (*Nevada Sta. Rpt. 1915, pp. 28–32*).—Notes are given on the growth and yield of varieties of alfalfa, potatoes, beets, field peas, corn, wheat, oats, barley, and millets.

The cultural value and identification of Spanish alfalfa, G. Gentner (*Prakt. Bl. Pflanzenbau u. Schutz, n. ser., 13 (1915), No. 10, pp. 136–139*).—Comparative tests of different kinds of alfalfa are reported, indicating that in general Spanish alfalfa grown in Germany is less productive than that grown from domestic and other seed sources. Turkestan alfalfa also ranked low in yield, standing next to the Spanish. The impurities found in the Spanish alfalfa seed, including inert material and weed seeds, are enumerated as a means of its identification.

Composition of the maize plant, J. W. Ince (*North Dakota Sta. Bul. 117 (1916), pp. 3–32, figs. 7*).—A study was made in 1914 and 1915 to determine the yield of mineral matter and organic constituents of the maize plant under North Dakota conditions, and to ascertain the best stage of cutting corn for silage. Analyses were made when the plants were in tassel, when the corn was in the milk, in the dough, when glazed, and when fully ripe. In 1914 the work was conducted at the main station and the substations at Dickinson, Edgeley, and Williston, while in 1915 it was pursued only at the main station. At Dickinson and Williston, Northwestern; at Edgeley, Minnesota No. 23; and at the main station, Mercer, were the varieties grown. The climatic conditions of the seasons are described, the meteorological data are presented by means of graphs, and the analytical results are shown in tables.

The composition of the corn at the different stages was compared with similar data for corn grown in New York and Indiana. According to these figures corn grown in North Dakta does not give as high yields of protein, fat, and carbohydrates as corn grown in New York or Indiana and the increase of these substances is not so rapid. It was found that the maximum yields for North Dakota were practically reached at the glazed stage, even a loss of protein being observed when the corn was ripe, while the data for the corn grown in New York and Indiana indicated a steady increase in all the constituents up to the maximum at the time of maturity.

Analyses of agricultural yield.—I. The spacing experiment with Egyptian cotton, 1912, W. L. Balls and F. S. Holton (*Phil. Trans. Roy. Soc. London, Ser. B, 206 (1916), No. 327, pp. 103–180, figs. 11*).—The investigations reported were entered upon to establish a statistical analysis of the yields of cotton in terms of the stages of the plant's development. The studies dealt mainly with the effects of spacing, the time of sowing, and the character of the season on Egyptian cotton grown at Giza. The numerical data recorded during the cultivation of the crop are presented in detail in a series of tables and graphs, and include records of daily flowering and weekly bolling for the 20 different spacings compared and of boll weight, seed weight, and ginning outturn, together with computed statistics of yield ratios.

It is concluded from the results that the yield of cotton is primarily dependent on the number of flowers formed. The normal extensions of the root system of an isolated cotton plant was found capable of utilizing more than 2 square meters of soil surface of soil which is more than 2 meters deep. As the plants in cultural practice have only 0.18 of a square meter, or less, each allowed them, most of the phenomena of field crop physiology in the fruiting season are regarded as traceable to the consequent interference of one root system with another. The yield per unit area of the conventional spacing practiced in Egypt was determined as the maximum obtainable under the limitations in field cultivation.

The sources of error in field experiments with cotton are enumerated as follows: Soil variation, especially below 1-meter depth, insufficient frequency of observation whereby accidental episodes can not be distinguished from normal sequences, fluctuation of single plants, heterogeneity of commercial varieties, and normal physiological variations from day to day.

Analyses of agricultural yield.—II. The sowing-date experiment with Egyptian cotton, 1913, W. L. BALLS and F. S. HOLTON (*Phil. Trans. Roy. Soc. London, Ser. B, 206 (1915), No. 333, pp. 403–480, figs. 18*).—The experiment described dealt with the yield obtained by planting Egyptian cotton at weekly intervals from February 15 to April 11, including nine planting dates. Five plats were planted each week and each plat contained a check row of about 150 plants. Statistical records, which are appended in tabular form, were obtained for the field germination, weekly height of the main stem, daily flowering, and weekly ripening of bolls.

It is concluded that the data derived from the work show the existence of an optimum date for planting which appears to be constant, or practically so, from year to year. It was found that plantings made before this date did not gain the corresponding average which might be expected, and that they might be even inferior. The result is explained by the assumption that some depressing factor is brought to bear on the early plantings which has less effect on later ones. This depressant factor is believed to be primarily an internal one induced within the plants. In this connection the authors show that internal water shortage leaves an after effect on the plant which can only be removed slowly by a restoration of an ample water supply. It is stated that this effect when severe may require the lapse of several weeks for its complete disappearance and in some instances it may never be quite overcome.

"It is probable that this after effect is due to the production of toxic excreta in such cells as grow under deficient water supply. . . . The fall in the growth rate of the main stem which takes place in Egypt after midsummer would seem to be due to the same factor, reasserting itself as the sole controller of growth . . . when the plants have grown so large that their closely packed root systems are inadequate to meet the loss by transpiration.

"The action of the depressant factor is essentially confined to a single group of meristematic cells. Thus the growth of the main stem may be checked but that of the younger flowering branches may continue, they having been developed from areas which did not produce the toxin, because they were not growing at the time when the toxin-provoking conditions were operative."

It is further concluded that the origin of this depressant factor can be attributed to the temperature of the soil, which is the only factor of the environment whose seasonal fluctuations are practically uniform from year to year.

Early and midseason potatoes at Wisley, 1915 (*Jour. Roy. Hort. Soc. 41 (1915), No. 2, pp. 290–304*).—Descriptions are given of 107 varieties of potatoes under trial. The varieties giving the best results were Duke of York and Midlothian Early varieties; General Joffre, Old Yellow Ashleaf, Sharpe Express, Sir John Llewelyn, Stirling Castle, and Winchill Seedling, medium early varieties; and Arran Chief, Great Scot, Stretton No. 20, and Wolfe Secundus, midseason varieties.

Sugar beets for factory purposes, F. T. SHUTT (*Canada Expt. Farms Rpts. 1915, pp. 155–160*).—The percentage of sugar and of solids in the juice of sugar beets, the coefficient of purity, the average weight per root, and the yield per acre are recorded for five varieties grown at the Dominion Experimental Farms in 1914. The average percentage of sugar in the juice of sugar beets grown on these farms from 1902 to 1914, inclusive, is also given in a table, and notes re-

garding the soil and season at the several farms and stations for 1914 are compiled.

Sudan grass in Kansas, G. E. THOMPSON (*Kansas Sta. Bul. 212 (1916), pp. 3–29, figs. 8*).—This bulletin presents a general discussion of Sudan grass culture, and reports the results of experiments relating to date and rate of seeding, yielding capacity with and without irrigation, comparative feeding value, and the usefulness of the grass for pasture. The chemical analysis of Sudan grass seed as compared with wheat, corn, oats, and Kafir corn, and the composition of Sudan grass hay as compared with alfalfa and prairie hay and sorghum fodder are given in tables. The experimental work was carried on at the main station and the various substations and partly in cooperation with the United States Department of Agriculture. The principal diseases attacking Sudan grass together with control measures are briefly described.

The results indicated in general that Sudan grass is primarily a hay crop which is adapted to practically all soils of the State excepting those very wet and poorly drained, extremely alkaline, or extremely sandy. It is stated that the crop may be planted and handled in much the same manner as the ordinary sorghums and that, when planted in cultivated rows, 2 to 4 lbs. of seed per acre are needed, while when broadcasted or drilled, 15 to 35 lbs. per acre give the best results. It was found that 2 to 3 cuttings for hay or one seed crop may be secured each season and that 400 lbs. of seed per acre or 2 to 4 tons of hay constitute an average crop. Comparative analyses showed that Sudan grass hay, while richer in protein than prairie hay, is not so rich as alfalfa hay. In feeding tests with dairy cows and with beef cattle and work horses and mules carried through the winter uniformly good results were secured. The results of pasture tests indicated this grass to be valuable in a limited way for grazing purposes and that it may have an important place on many farms in furnishing grazing for hogs.

The time to seed wheat in Kansas, L. E. CALL, S. C. SALMON, and C. C. CUNNINGHAM (*Kansas Sta. Bul. 213 (1916), pp. 3–16, fig. 1*).—Experiments to determine the best time to seed wheat were begun in 1911 at the station and at six places in as many counties in the main wheat-producing area of the State where the Hessian fly is likely to cause serious loss. In each test a series of plats was sown at weekly intervals for six or seven weeks, beginning the second week in September. The outcome of the tests is given in tables and is briefly discussed.

It was found that in central and eastern Kansas wheat may be sown late enough to avoid most of the injury from Hessian fly and yet early enough on well-prepared ground to secure a good growth before winter. The dates given as best for seeding are as follows: Northeastern Kansas from about September 25 to October 3, southern central Kansas from about September 25 to October 7, and northern central Kansas from about September 20 to October 1. It is pointed out that as the time for seeding western Kansas depends on the rainfall, the land should be prepared early and seeded when in proper condition to insure germination and good growth. It is further stated that wheat may be sown later in rich soil on well-prepared ground than in soil that is poor or poorly prepared, as early and thorough preparation not only destroys many of the flies but enables the wheat to make a more rapid, vigorous, and resistant growth.

Tests to observe the effect of the time of seeding on the tillering of wheat showed that the rate of seeding made very little difference in the yield when the sowing was done before September 28. After this date the higher rates of seeding gave the best yield.

Liming the wheat crop, C. E. THORNE (*Mo. Bul. Ohio Sta., 1 (1916), No. 9, pp. 277–281, figs. 3*).—This article presents some results obtained from experi-

ments at Wooster comparing the effects of liming upon the yields of wheat on fertilized and unfertilized and manured plats. It is concluded that liming is of fundamental importance on this soil, and that neither manure nor other combinations of fertilizers will produce a full yield without lime.

Seed analyses made during 1912–1915, MARY H. JAGGER and E. M. STODDARD (*Connecticut State Sta. Rpt. 1915, pt. 6, pp. 497–513*).—The work for the period is described and notes on the samples of clover, alfalfa, and grass seeds examined are given. The results of analyses of red clover seed samples secured in 1913, and including the number of noxious weed seeds and other foreign seeds other than weeds per pound, are tabulated, and germination and vitality tests with different kinds of seeds, including vegetable and tree seeds, are described.

Reported data on the vitality and sprouting capacity of onion seed show that the varying number of samples of Connecticut grown seed tested from year to year, from 1894 to 1912, inclusive, and less than one year old, contained on an average 75.5 per cent of seeds capable of sprouting. A comparison of onion seed samples less than one year old with samples more than one and less than four years old, showed a loss of vitality with the increasing age of the seed. Nineteen samples of Connecticut-grown onion seed separated into heavy and light seeds showed an increase in germination ranging from 2.5 to 36 per cent in favor of the heavy seed.

HORTICULTURE.

Report from the division of horticulture for the year ended March 31, 1915, W. T. MACOUN ET AL. (*Canada Expt. Farms Rpts. 1915, pp. 581–617, 619–673, 674–692, 694–702, 704–736, 741–746, 747–750, 751–759, 762–773, 774–786, 788–795, 797–800, 803–813, 815–841, 842–846, 848–854, 855–863, pls. 12*).—A detailed report on results secured in 1914 in the breeding, cultural, and variety experiments with fruits, vegetables, forest and ornamental trees, and herbaceous plants, conducted at the Central Farm, Ottawa, and at the various branch experimental farms and stations in Canada. A summary of the more important results has appeared previously in bulletin form (E. S. R., 33, p. 236). Analyses of several commercial brands of arsenate of lead are also included.

[State insecticide and fungicide laws] (*U. S. Dept. Agr., Insecticide and Fungicide Bd. Serv. and Regulatory Announcement 13 (1916), pp. 101–152*).—This comprises a compilation of state laws dealing with the manufacture and sale of insecticides and fungicides as amended to date. The subject matter is based upon publications and other information relating to such laws furnished to the Federal Insecticide and Fungicide Board by state officials.

The relation of fruit growing to soil fertility, R. C. THOMPSON (*Arkansas Sta. Bul. 123 (1916), pp. 3–8*).—In the spring of 1906 young peach and apple orchards were set out at the station, and data were collected annually for a period of nine years on the amount of plant food taken from the soil by individual trees of the orchards. A total of 90 apple trees and 36 peach trees were analyzed during the experiment. The following table shows the total amount of plant food taken up by peach and apple trees for the production of wood and leaves, as well as an estimate of the amount of plant food that was returned to the soil by the dead leaves and other means during the nine years of the experiment. The data are calculated on a basis of 100 peach trees and 40 apple trees per acre.

Losses in soil fertility per acre in growing fruit trees.

	Peach trees.			Apple trees.		
	Phosphoric acid.	Nitrogen.	Potash.	Phosphoric acid.	Nitrogen.	Potash.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Total plant food taken up by trees in the nine years	50.83	215.90	237.60	9.26	28.10	27.22
Total plant food retained in trees at the end of the ninth growing season	27.67	87.97	60.18	6.73	15.26	14.25
Total plant food returned to the soil by leaves, etc., during the nine years	23.16	127.93	177.42	2.53	12.84	12.97

From these data the author concludes that the total loss for the growth of an acre of trees to maturity is scarcely more in quantity, though different in proportion of elements, than that contained in 100 bu. of corn.

Analyses were made of the fruit to determine the total loss in soil fertility by the removal of a crop, and the average percentage composition of all samples of fruit analyzed was used in making the following calculation:

Comparison of the amount of plant food removed from the soil by peach and apple fruit and corn.

Crop.	Yield per acre.	Fruit or grain.	Dry matter.	Phosphoric acid in crop.	Nitrogen in crop.	Potash in crop.
	Bu.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Apple	500	25,000	3,675	6.61	13.45	43.05
Peach	500	25,000	3,500	11.90	22.30	59.50
Corn	50	2,800	2,503	19.88	46.20	15.96

From the data secured as a whole it appears that apple production will exhaust the soil much more slowly than corn or grain crops. Peach trees resemble apple trees in their demands, the principal difference being that more plant food is required for a crop of peaches than for a crop of apples. In the presence of sufficient moisture and other conditions suitable for fruit culture the principal soil fertility and fertilizer problems confronting the orchardist is the building up of the soil by means of commercial fertilizers and manure to a normal state of fertility. For this purpose it was concluded that 8 or 10 tons of barnyard manure applied per acre every three years followed by green manure crops and proper tillage is sufficient.

[The effect of site on blossom development and frost injury], J. E. Church, Jr. (*Nevada Sta. Rpt. 1915, pp. 52, 53*).—Observations made of a few orchards during the spring of 1915 indicate that when frost occurs with wind orchards which are protected from the wind by hillsides or other screens suffer much less injury than when the exposure is complete. Frost injury increased with the stage of development of the blossoms.

Orchard rejuvenation in southeastern Ohio, F. H. Ballou (*Ohio Sta. Bul. 301 (1916), pp. 3–40, figs. 23*).—In this bulletin the author reviews previous experiments in orchard fertilization and culture conducted by the station (E. S. R., 28, p. 47) and gives the results of more recent experiments in orchard fertilization.

The completion of a 5-year period of work in orchard fertilization at three different locations in southeastern Ohio has confirmed previous conclusions that

the thin upland soils of central, eastern, and southern Ohio are seriously deficient in nitrogen, and that the application of readily available nitrogen in such cases surprisingly transforms the starving, unproductive orchards into those that are vigorous, productive, and profitable. There has been little evidence of additional benefit derived when acid phosphate and muriate of potash as sources of phosphorus and potassium have been combined with nitrate of soda, so far as tree growth or yield and appearance or texture of fruit are concerned.

Nitrate of soda has given more favorable results than slower-acting organic sources of nitrogen. The results of 4-year tests of fertilizers with a straw mulch as compared with double-rate fertilization without a mulch of straw have shown the heavier fertilization without mulching material to be most advantageous. This result is attributed chiefly to the beneficial results of nitrate of soda, which has encouraged the natural substitution of grasses and clovers in place of an almost worthless soil covering of weeds and poverty grass. These grasses and clovers cut and used as a mulch have yielded better returns than the straw mulch.

Although acid phosphate has been of little direct fertilizing value to the orchard, the experiments show that applications of acid phosphate used either alone or in combination with muriate of potash have caused the small scattering clover plants to increase noticeably in size and gradually take possession of the soil. After the clover had attained its maximum development, disappeared, and left in connection with the decaying roots a liberal store of available nitrogen, the better grasses began to come in. With the supply of nitrogen from the clover a marked improvement in wood growth, foliage development, and disposition to produce fruit was observed among the apple trees.

Relative to the practical application of this method of providing nitrogen by means of acid phosphate, the author points out that it is too slow for practical use where prompt results in fruit production are desired. It is suggested, however, that the use of nitrate of soda with acid phosphate in such a way as not to stimulate the production of the various grasses to the extent that the clover will be crowded or smothered out may prove to be the most economical method of renovating these hill soils. Experimental tests of such a combination have shown that where nitrate of soda at a rate of not above 200 lbs. in combination with 200 lbs. and upward of acid phosphate is applied evenly over the orchard, very nearly as good results are obtained from nitrate as where it is applied in a circle under the outer extremities of the branches, without counterbalancing the beneficial effects of the phosphate in clover encouragement.

A test of cultivation versus the grass-mulch method of culture was conducted for two years, with financial results slightly in favor of the grass-mulch method of culture.

Variation of internal structure of apple varieties, E. J. Kraus (*Oregon Sta. Bul. 135 (1916), pp. 3–42, figs. 164*).—In connection with apple studies conducted at the station (E. S. R., 29, p. 541; 32, p. 855) considerable variation was found to exist in the internal structure of different varieties of apples. The author has undertaken a much more extended study of internal fruit structure. The present bulletin outlines the nature of this investigation, and contains a number of plates showing variations in internal structures of a number of different varieties of apples and pears. The more important differences are briefly noted, but no conclusions are drawn nor interpretations made of the data at this time.

Effect of pruning peach trees at different heights previous to planting in the orchard, M. A. Blake (*New Jersey Stas. Bul. 293 (1916), pp. 3–30, figs. 14*).—This bulletin reports the results of growth studies with peach trees pruned at various heights at the time of planting. Trees calipering $\frac{1}{4}$, $\frac{3}{8}$, $\frac{5}{8}$, $\frac{1}{2}$, and $\frac{5}{8}$ in.

were used in the experiments, and comparisons were made between trees dug in the fall and stored over winter in a nursery storehouse, trees dug in the spring and allowed to dry out through improper handling, and freshly dug trees. The following pruning treatments were used: Not pruned and cut back to 36, 30, 24, 18, 12, and 6 in. trunks, respectively. Observations were made at the close of the growing season and are here presented in tabular form and fully discussed.

The work as a whole is summarized as follows: "One-year-old peach trees of a ⅝ or ¾ in. grade made the largest average total growth. The larger the trees the poorer is the growth when unpruned at planting time. The smaller the trees, the greater is the damage if the trees are allowed to become dry before planting.

"The largest average total growth regardless of the grade was made by trees cut to a 36 in. trunk when set except in the case of dried-out trees. Trees cut to 12 in. trunks when set made the next largest average total growth.. The smallest average total growth occurred when trees were cut to 18 in. trunks when set.

"Trees of a ⅜ in. grade made the largest amount of growth when cut back to 6 in. trunks when set. Trees as large as ¾ in. or larger were depressed in growth when cut back to 6 in. trunks.

"Trees in general failed to develop branches well upon the 12 to 24 in. section of the trunk. It was later observed that very few well-developed buds occur upon this section of the tree under average conditions. The largest total number of branches was found to occur in the lengths from 7 to 12 in. The largest average total number of branches of all lengths occurred in the 36 in. treatment, with the 12 in. treatment second. The number of branches of all lengths is, therefore, apparently correlated with the amount of growth.

"The unpruned trees developed the smallest number of branches that were more than 24 in. in length. The 36 in. trees developed the largest number of branches that were more than 24 in. in length. The 6 in. treatment resulted in the formation of the largest number of branches 40 to 50 in. in length. The 12 in. treatment gave the largest number of branches 37 to 40 in. in length. The 18 in. treatment gave the largest number of branches 30 to 36 in. in length. The 24 in. treatment gave the largest number of branches 25 to 30 in. in length.

"We may, then, conclude that the more severe the pruning the greater the tendency to produce long branches. It should be noted, further, however, that so-called main branches are reduced in number when the trees are cut to 6 in.

"One-year peach trees from the nursery start into growth best when planted in the orchard if there are well-formed buds just below the point where the tree is cut back. The number of such buds varies at different points along the trunk of a nursery tree. Buds are found to be most numerous at the 36 to 42 in. space followed in order by the 42 to 48 and the 0 to 6 in. spaces. Buds are found to be least numerous at the 6 to 12 in. space followed in order by the 12 to 18 and the 24 to 30 in. spaces.

"Peach trees at the time of planting should be pruned somewhat according to grade and the character of the stock, and not according to some definite height regardless of all other factors."

A financial statement of the experiment station peach orchard, C. A. McCue (*Delaware Sta. Bul. 113 (1916), pp. 3–21*).—This comprises a detailed survey of the cost of growing peaches in the station orchard of some 1,000 trees during the period 1908 to 1915, inclusive.

Starting out with an original investment for land of $100 an acre the orchard was still in debt $209.65 at the end of the sixth year. The combined profits

of the seventh and eighth years, or for the whole 8-year period, was $2,280.52. The average yearly profit was $29.81 per acre, which is equivalent to 29.8 per cent on the original investment of $100 an acre or a 5 per cent return on an orchard valuation of $596.20 an acre. The cost of raising a 16-qt. Delaware basket of peaches during the whole period was 34.472 cts., and the net profit per basket was 12.923 cts.

Report of cranberry substation for 1915, H. J. Franklin (*Massachusetts Sta. Bul. 168* (*1916*), *pp. 48*).—This bulletin contains a full report on the work of the cranberry substation at East Wareham for the year 1915 (E. S. R., 33, p. 341).

The usual weather observations were made during the year and experiments with tobacco shade cloth for frost protection were continued, with the general result, however, that its use for this purpose appears less advisable than the 1914 tests seemed to indicate. The difficulties connected with its manipulation on the bog are evidently considerable. The author is of the opinion that a cheaper and more certainly effective means of protection may be had on most unprotected bogs through flooding these areas by means of small pumping plants.

In connection with a study of fungus diseases extensive storage tests were conducted during the fall and early winter to determine the effects of some of the factors affecting the keeping quality of cranberries. The results of a number of these tests are here presented in tabular form. They show the relation of ventilation to rate of decay, water losses of cranberries in boxes of different construction and in different periods of the storage season, and injury to keeping quality of cranberries caused by their drop into barrels. Other storage tests and observations are also noted.

The tests as a whole show that while ventilation is a very important factor in retarding the development of rot, it is of doubtful economic value except in storage house construction. The most rapid development of decay takes place in the very first part of the storage season. Berries of poor keeping quality are usually shipped as soon as possible after they are picked and it is only with such fruit that the maximum benefit to be gained by superior arrangements for ventilation would be realized. In lieu of extensive ventilating equipment the thorough airing of the storage house on cool, dry days and the allowance of as much space in the storage of the fruit as possible is recommended. Special attention to the keeping down of temperatures appears to promise fully as great advantages as far as storage previous to shipment is concerned as can be obtained from special arrangements for ventilation.

Much injury is done to the keeping quality of cranberries by the bouncing of the berries in the separators commonly used and by their drop into the barrels in separating and screening. In view of their greater expense the use of less injurious separators appears to require the establishment of community packing houses. Although the barrel is the common method of shipping cranberries it appears to be undesirable for this purpose, both from the standpoint of mechanical injury and ventilation. The author is of the opinion that fruit to be shipped to the trade in the more distant parts of the country would be in a far more acceptable condition if crated and shipped in the uncleaned condition, to be prepared for market at central distributing points in the territory where it is to be consumed.

Experiments in resanding cranberry bogs were continued (E. S. R., 31, p. 740). The results with reference to quantity and keeping quality on the sanded and resanded plats are here presented and compared with the results secured in previous years. Briefly summarized, the plats have shown no very

definite effect on the quantity of fruit produced resulting from resanding or the lack thereof. The author concludes that the advantages gained by resanding are of such a general nature—a certain amount of frost protection and help in the control of the tip worm and girdler being the most evident—that they are not definitely determinable by means of plat experiments.

A résumé is given of the results secured from fertilizers with reference to the effect on quantity and keeping quality of cranberries from 1911, when the experiments were started, up to the present time. The data given indicate a moderate average increase in the quantity of fruit obtained during the five-year period from the fertilized areas as compared with that from the checks. Nitrate of soda appears to have impaired the keeping quality of the fruit somewhat, while no effect in this respect connected with the use of acid phosphate and sulphate of potash is apparent. Results on one of the limed plats suggest the inference that lime favors the development of some disease that is peculiar to the Early Black variety of cranberry. Experiments with fertilizers to determine the possibility of stimulating and increasing the setting of cranberry blossoms were continued, no very distinct advantage in quantity of fruit being shown by the fertilized areas. The berries from three of these plats were put in storage tests, and all showed an impaired keeping quality in comparison with the fruit from the checks.

With experience gained from the cranberry investigations as a basis, the author here presents and discusses for the consideration of Massachusetts growers a number of ideas relative to changes in bog management looking to more successful culture and marketing practices. The season's work with plant diseases and insects is noted on pages 51 and 54.

FORESTRY.

Annual report of the director of forestry of the Philippine Islands for the fiscal year ended December 31, 1915, W. F. Sherfesee (*Ann. Rpt. Dir. Forestry P. I., 1915, pp. 91, pls. 2*).—This is the usual progress report relative to the administration, investigation, management, and reconnoissance work for the year ended December 31, 1915. Data relative to applications for homesteads, purchases, and leases of public lands, timber cut by species, revenues, timber licenses, utilization of forest products from the public forests, and exports and imports of major and minor forest products are appended.

Report on state nurseries and plantations, T. N. Brodrick et al. (*New Zeal. Dept. Lands, Rpt. State Nurseries and Plantations, 1915, pp. 32*).—A report of forest operations on the various state nurseries and plantations in New Zealand for the year ended March 31, 1916.

Report of the chief forest fire warden for the year 1915, G. H. Wirt (*Penn. Dept. Forestry Bul. 13 (1916), pp. 182*).—This includes a report on forest fires in Pennsylvania in 1915, activities dealing with forest protection, and a review of forest-fire legislation in the State by I. C. Williams.

Grass and woodland fires in Texas, J. H. Foster (*Bul. Agr. and Mech. Col. Tex., 3. ser., 2 (1916), No. 5, pp. 16, figs. 5*).—In this bulletin the author calls attention to the serious damage done, both to the agricultural and forestal industries of Texas, through grass and woodland fires, and gives the text of the laws of the State dealing with forestry and forest protection.

Importance of soil aeration in forestry, R. S. Hole (*Agr. Jour. India, Spec. Indian Sci. Cong. No., 1916, pp. 27–32, pls. 5*).—In this paper the author discusses the damage that may be done to the seedlings of forest trees by insufficient soil aeration when the physical condition of the soil is apparently

suitable for growth and when the soil, although moist, is far from being saturated with water. The discussion is based upon results secured in experiments with seedlings of the sal tree (*Shorea robusta*).

A preliminary study on the culture of exotic forest species in Italy, A. Pavari (*Ann. R. Ist. Sup. Forestal Naz. Firenze, 1 (1914–15), pp. 159–379*).—The author here presents the results of a survey of the distribution and climatic requirements of the more important timber species. The work was conducted with special reference to its application in subsequent attempts to acclimatize foreign species in Italy.

Notes on acacia, with description of new species, I, J. H. Maiden (*Jour. and Proc. Roy. Soc. N. S. Wales, 49 (1915), pt. 3, pp. 463–513*).—This paper discusses the various species of acacia and describes a number of proposed new species.

Notes on Eucalyptus, with descriptions of new species, IV, J. H. Maiden (*Jour. and Proc. Roy. Soc. N. S. Wales, 49 (1915), pt. 3, pp. 309–331*).—In continuation of previous papers (E. S. R., 34, p. 742), the author describes a number of new species of eucalypts and gives notes on some species previously described.

Eucalyptus australiana n. sp. (narrow-leaved peppermint) and its essential oil, R. T. Baker and H. G. Smith (*Jour. and Proc. Roy. Soc. N. S. Wales, 49 (1915), pt. 3, pp. 514–525*).—A systematic description of narrow-leaved peppermint (*E. australiana* n. sp.), together with an account of its essential oil, including analytical tests made at the Technological Museum.

Notes on the tapping of Para rubber, W. G. Freeman (*Bul. Dept. Agr. Trinidad and Tobago, 15 (1916), No. 5, pp. 155–162*).—The author reviews the results obtained by modern tapping systems in various countries, and gives data showing the results of tapping experiments conducted at the St. Clair Experiment Station during the period 1911 to 1916, inclusive.

A new steam tree feller, J. Scrimgeour (*Trans. Roy. Scot. Arbor. Soc., 30 (1916), pt. 2, pp. 126–128, pls. 2*).—The author describes and illustrates a new steam tree feller which has been successfully used in Scotland for a number of months.

Selling woodlot products on Michigan farms, E. H. Frothingham (*Lansing, Mich.: State, 1916, pp. 49, pls. 11*).—This bulletin is based upon a statistical survey of the wood-using industries of Michigan, conducted by the Forest Service of the U. S. Department of Agriculture in cooperation with the Public Domain Commission of the State of Michigan. It discusses the woodlot situation in Michigan, the common woodlot trees, marketing woodlot products destined for various industries, methods of conducting the sale, how to prevent the deterioration of cut woodlot products, and some of the principal uses of the common woodlot trees. A directory of Michigan firms buying woodlot products in the rough is included.

Forest products of Canada, 1915.—Pulpwood (*Dept. Int. Canada, Forestry Branch Bul. 58B (1916), pp. 12, pl. 1, figs. 4*).—A statistical account of the pulpwood industry of Canada for the year 1915, including comparative data for the previous year.

Proceedings of the twelfth annual meeting of the American Wood Preservers' Association, F. J. Angier (*Proc. Amer. Wood Preservers' Assoc., 12 (1916), pp. 432, pls. 2, figs. 52*).—In addition to the regular business pertaining to the association, the proceedings contain reports of the following papers and discussions given at the annual meeting, held in Chicago, January, 1916:

Creosoted Piling and Poles, by F. W. Cherrington (pp. 61–70); Methods of Creosoting Douglas Fir Timbers, by O. P. M. Goss (pp. 70–83); Vacuum Process

in Creosoting, by J. D. Isaacs (pp. 83–86); Notes on Measuring Devices and on Methods of Determining Cubical Contents per Charge, by C. W. Lane (pp. 86–91); Selecting and Buying Fuel, by W. H. Grady (pp. 91–104); The Foreign Creosote Oil Situation, by G. A. Lembcke (pp. 104, 105); Woods Suitable for Cross-ties, by R. Van Metre (pp. 106–109); Quantity of Zinc Chlorid per Tie or per Cubic Foot of Timber, and Method of Determining the True Strength of the Solution, by W. F. Goltra (pp. 109–117); Marine Borers from the Wood Preservers' Standpoint, by L. F. Shackell (pp. 124–135); Report of Special Committee on Specifications for Preservative for Wood Paving Blocks, by S. R. Church et al. (pp. 135–148); Discussion on Preservative Specifications for Wood Paving Blocks, by A. E. Larkin (pp. 148–164); Water Sampling in Creosote Oil (pp. 164–168); Report of Committee on Specifications for the Purchase and Preservation of Treatable Timber, by E. A. Sterling et al. (pp. 171–187); Fungi Which Grow on Untreated Ties or Untreated Wood, by H. von Schrenk (pp. 187–202); Treated Wood Block for Factory Flooring and Miscellaneous Uses, by C. H. Teesdale (pp. 202–210); Report of Committee on Wood Block Paving, by C. H. Teesdale et al. (pp 210–225); Report of Committee on Service Tests of Wood Block Paving, by A. E. Larkin et al. (pp. 225–237); Discussion on Woods Suitable for Cross-ties, by C. P. Winslow and J. A. Newlin (pp. 238–247); Reclaiming Arid Lands, by F. H. Newell (pp. 247–257); Report of Committee on Service Tests of Cross-ties, by C. P. Winslow et al. (pp. 257–265); Durability Records of Cross-ties, by C. P. Winslow and C. H. Teesdale (pp. 265–333); Report of Committee on Service Tests of Bridge and Structural Timber, by H. M. Rollins et al. (pp. 333–342); Quantity of Wood Preservatives Consumed and Amount of Wood Treated by Wood-preserving Plants in the United States in 1915, by R. K. Helphenstine, jr., and H. S. Betts (pp. 380–408); and Bibliography of Wood-boring Crustaceans, by F. Moll (pp. 409–413).

An index to the contents of previous proceedings is appended.

DISEASES OF PLANTS.

Pathological plant anatomy, E. Küster (*Pathologische Pflanzenanatomie. Jena: G. Fischer, 1916, 2. ed., pp. XI+447, figs. 209*).—The author presents in this edition not only the material retained from the former one, which has been translated by Miss Dorrance (E. S. R., 34, p. 49), but also a considerable amount of new material, with a rearrangement of the general plan, bringing the work up to the date of its practical completion about August, 1914. There is also added a list of recent contributions by other authors extending to November, 1915.

Tumors in plants, E. F. Smith (*Science, n. ser., 44 (1916), No. 1139, pp. 611, 612*).—The author reports having succeeded in producing small tumors in plants without the use of the crown gall organism (*Bacterium tumefaciens*) by means of substances which are by-products of bacterial growth. Small tumors are said to have been obtained repeatedly on several kinds of plants, and their presence is interpreted as being due to the fleeting chemical stimulus applied.

A paper describing in full the investigation is promised for early publication.

How to identify infectious plant diseases, S. F. Ashby (*Jour. Jamaica Agr. Soc., 20 (1916), No. 1, pp. 6–12*).—This information, said to be available also in pamphlet form, relates, among other matters, to the symptoms, causation, and treatment of Panama disease or banana wilt, Bonnygate disease or banana bulb rot, cacao pod rot and red or purple canker, dieback of cacao, bud rot of coconut palm, and leaf dieback of coconut.

Report of the division of botany, H. T. Güssow (*Canada Expt. Farms Rpts. 1915, pp. 949–990, pls. 11, figs. 2*).—An account is given of some administrative

features in connection with the enforcement of the destructive insect and pest act, investigations in plant pathology, economic botany, and a report of the St. Catharines field laboratory. The work reported in the administration of the destructive insect and pest act has consisted largely of inspection of potatoes for shipment.

In plant pathology, the diseases reported upon are principally those of potatoes, a number of which are described, and the results of experiments are given in some cases. Experiments on the effect of fresh manure on potato scab show that fresh horse manure increased the amount of scab more than any of the others used, while the use of sheep and hen manure resulted in the smallest amount of scab. A potato disease called net necrosis is briefly described. This is characterized by brownish discolorations of the fibrovascular bundles of the tubers. Some experiments were undertaken to determine whether tubers that showed this infection before planting would produce a crop free from the disease, and the results indicate that in almost every case the disease is hereditary. Some investigations on the control of Rhizoctonia or black scurf of potato, due to *Corticium vagum solani*, are reported in which it appears that treating seed tubers for three hours with a solution of corrosive sublimate in connection with rotation of crops has greatly reduced loss from this disease. Notes are given on the distribution and characteristics of black leg, leaf roll, and mosaic disease of potato. A clover and alfalfa wilt disease due to *Sclerotinia ciborioides*, or *S. trifoliorum*, is briefly described, and two authentic cases of its occurrence in Canada are reported.

In the investigations in economic botany, most of the work has been concerned with the identification of poisonous plants and weeds.

In the report from the field laboratory at St. Catherines, W. A. McCubbin gives observations and experimental results on the more important diseases of fruits and vegetables observed during 1914. Most of the investigations are said to be incomplete and are only briefly described.

Notes on plant diseases of Connecticut, G. P. CLINTON (*Connecticut State Sta. Rpt. 1915, pt. 6, pp. 421–451, pls. 8*).—Notes are given on a number of plant diseases observed during 1914 and 1915, including some previously reported and a number of others not before recorded from the State. Among the latter are white spot of alfalfa; several rots of apples; white tip of carnations; mosaic or white pickle of cucumber; leaf blight, crown gall, and a root rot of mangels; anthracnose of Norway maple; a Fusarium rot of onions; two rusts of poplar, one of which is associated with the larch, the other with hemlock; crown gall of privet; and a bacterial leaf spot of soy beans, which is provisionally described as due to *Bacillus* sp.

Report on plant protection, E. SCHAFFNIT and G. LÜSTNER (*Berichte über Pflanzenschutz der Pflanzenschutzstellen. Bonn: P. Rost & Co., 1916, pp. 98, figs. 11*).—This contains the reports of the stations for plant protection at Bonn-Poppelsdorf and Geisenheim for 1913–14 regarding weather and plant injury as related to diseases and animal pests.

Administration report of the government mycologist for 1914–15, W. MCRAE (*Rpt. Dept. Agr. Madras, 1914–15, pp. 50, 51*).—It is stated that a coliform bacillus isolated from the soft rotting parts of coconut and palmyra palms attacked by bud rot did not reproduce the rot when injected into the buds of young coconut palms. The results of inoculations of these plants with pure cultures of *Pythium palmivorum* confirmed the experiments of the previous year. Bud rot of coconut palms appears to be widely spread in Malabar, but the damage done is not extensive. Investigation of a new disease of coconut palms on the west coast has been begun.

The use of Bordeaux mixture for the mahali disease of areca nuts, due to *Phytophthora omnivora arecæ*, is being extended. A fungus (probably an Ephelis) on paddy, which transforms the loose panicle into a solid carbonaceous spike, has been brought into pure culture, and a study of the fungus has been begun. A fruit rot of chillies caused by *Vermicularia capsici* is under investigation. A bacterium isolated from black rot of plantain had no effect on young plantain shoots.

Septoria on barley, A. G. JOHNSON (*Abs. in Phytopathology, 6 (1916), No. 1, p. 117*).—The author notes the occurrence of Septoria on a number of varieties of barley at different localities in North and South Dakota and Minnesota. The fungus chiefly attacks the leaf blade, the attacked portion becoming yellowish or yellowish brown and the invaded tissue being killed. The sheaths are less frequently attacked. The fungus is believed to be the same as that known to occur on wheat and to be widely distributed in this country and generally referred to *S. graminum*.

Occurrence of yellow leaf rust of wheat (Puccinia glumarum) in the Salt Lake Valley, Utah, P. J. O'GARA (*Science, n. ser., 44 (1916), No. 1139, pp. 610, 611*).—The author describes a rust as having been observed on June 23, 1915, in several wheat fields north and west of Ogden, Utah. Subsequent examination showed the rust to be *P. glumarum*, which has only recently been described as occurring in this country. The infection as noted in the Salt Lake Valley is said to have been rather severe and of considerable economic importance.

Cordyceps clavicipitis n. sp., parasitic on ergot, R. ÖRTEGREN (*Svensk Bot. Tidskr., 10 (1916), No. 1, pp. 53–58, figs. 3*).—The author describes *C. clavicipitis* n. sp., which is claimed to be parasitic on ergot (*Claviceps purpurea*).

Californian thistle rust, A. H. COCKAYNE (*New Zeal. Dept. Agr. Rpt. 23 (1915), p. 109*).—It is stated that a considerable amount of experimentation with Californian thistle rust (*Puccinia suaveolens*) has been carried out, the results of which indicate that this rust may become a valuable instrument in controlling the weed in permanent pastures. The best results are obtained by using material which has been taken from plants recently attacked in preference to that from plants affected the previous year, the latter attaining only a temporary development.

A study on the dry rot disease of maize caused by Diplodia zeæ, P. A. VAN DER BIJL (BYL) (*Union So. Africa Dept. Agr. Sci. Bul. 7 (1916), pp. 60, pls. 15*).—This investigation, which was undertaken primarily to test the effect of diseased maize when fed to stock, deals somewhat extensively also with the biology, pathology, and control of the disease of maize caused by *D. zeæ*. The two parts of the paper deal respectively with the fungus in relation to the host and the fungus in the laboratory. Inoculation apparently takes place through the silks but possibly also through the roots. No ear to ear infection was obtained. The spores do not appear to be very resistant.

It is recommended that crop rotation be accompanied by destruction of all diseased material prior to the formation of pycnidia. It is thought that the fungus may fruit naturally on débris other than that of maize in the field. Further experiments are needed regarding the ways in which the disease is spread.

Powdery scab of potato, G. P. CLINTON (*Connecticut State Sta. Rpt. 1915, pt. 6, pp. 463–469*).—On account of the occurrence of the powdery scab of potato in Maine and the possibility of its being introduced into Connecticut, the author, with his assistants, made an inspection of seed potatoes with the result that the powdery scab was found only at three places, in all of which the infection occurred on Maine-grown tubers.

Experiments were conducted to determine the probability of the establishment of this disease in Connecticut, and tubers were planted in clean soil after being treated with formalin alone or with formalin and dusted with sulphur. No powdery scab appeared, and another experiment was undertaken on the supposition that the soil might have become infected. Badly scabbed potatoes were received and planted in a new plat, and potatoes treated as above were planted in the places occupied by the potatoes in the previous experiments. The potatoes when dug showed no powdery scab, even under microscopic examination. The author concludes that this disease is not likely to prove a serious one in Connecticut.

Seed and soil disinfectants for the Rhizoctonia disease of potatoes, W. J. MORSE and M. SHAPOVALOV (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 118, 119*).—Seed tuber treatment for the control of Rhizoctonia disease of potatoes was found more successful with corrosive sublimate than with formaldehyde. The application of sulphur in the soil at the rate of 500 lbs. per acre increased the diseased plants from 20 to 30 per cent.

Potato spraying experiments, third report, G. P. CLINTON (*Connecticut State Sta. Rpt. 1915, pt. 6, pp. 470–487*).—In continuation of a previous report (E. S. R., 25, p. 545), the author gives the results of spraying experiments which have covered a period of 14 years. These experiments were undertaken to determine the value of Bordeaux mixture as a fungicide, to compare the effect of ridged and level culture in preventing rot of tubers, and the value of other fungicides as compared with Bordeaux mixture.

Homemade 4 : 4 : 50 Bordeaux mixture gave an average increase of 38 bu. per acre during the 13 years the tests were carried on. Not only did the Bordeaux mixture control blight, but in dry years lessened injury from tip burn and had also possibly a stimulating effect as shown by an average increase of 29 bu. per acre during blight-free years. In all but 4 of 22 tests, the extra cost of spraying was more than covered by the net gain.

In the experiments with ridged *v.* level culture, it was found that ridging and deeper planting tend to lessen rot and blight of potatoes in bad seasons, and in addition, the ridging permits better spraying and easier access to the plants. The total yields of ridged potatoes were as high as those from level culture, the yields of first quality potatoes were greater, and the tubers were less subject to sunburn.

In the comparative test of fungicides, none was found to equal homemade Bordeaux mixture.

A new species of Melanconium parasitic on the tomato, W. H. TISDALE (*Abs. in Phytopathology, 6 (1916), No. 1, p. 116*).—On both green and ripe tomatoes in the greenhouse at the Wisconsin Experiment Station, small, dark brown or black spots, seldom more than ⅛ in. in diameter, have been observed. From these a fungus was isolated and inoculations were made both through wounds and by spraying unwounded fruit. The characters of the fungus are said to correspond to those of the genus Melanconium, although no record of the parasitism of this genus on the tomato has been found.

Infection and resistance studies of Phytophthora infestans on the tomato, I. E. MELHUS (*Abs. in Phytopathology, 6 (1916), No. 1, p. 107*).—The author reports tomato foliage as readily infected with *P. infestans* from the Irish potato, but it has not been possible to infect the fruit except through the peduncle, the calyx, or the epidermis when ruptured. The fungus is said to spread more sparingly on the foliage of the tomato than on susceptible varieties of potato. Variations in susceptibility of different varieties of tomato and potato to attack by this fungus are reported.

Second progress report on disease resistance in tobacco, J. Johnson (*Abs. in Phytopathology, 6 (1916), No. 1, p. 117*).—In continuation of a report on resistance of tobacco to the root rot organism (*Thielavia basicola*) previously noted (E. S. R., 31, p. 448), the author reports encouraging results of selection for resistance in the White Burley variety.

Disinfection to overcome the root rot (Thielavia basicola), W. A. Barnet (*Canada Expt. Farms Rpts. 1915, pp. 1191-1193*).—The sterilization of seed beds by means of steam and formalin is described, the steam sterilization proving very satisfactory, while the formalin treatment under the conditions of the experiment was not a success. Treatment with steam for 30 minutes at 100 lbs. pressure is recommended for general practice. Some notes are given on the resistance of varieties of tobacco to root rot infection, and from the author's observations it is thought that by selection and breeding a resistant variety of tobacco can be obtained that will be commercially profitable.

Fire blight investigations, H. A. Gossard and R. C. Walton (*Mo. Bul. Ohio Sta., 1 (1916), No. 9, pp. 274-276; abs. in Phytopathology, 6 (1916), No. 1, p. 113*).—A series of investigations is reported upon in which an effort has been made to determine under what conditions and how long the fire blight organism (*Bacillus amylovorus*) will live in honeydew as it occurs on the leaves, how long it will retain its vitality in the nectaries of other flowers than apple, pear, and quince, and how long it will live in honey.

It was found that the blight organism can live for 7 days in honeydew until the dew is completely dried, and then for at least 3 days longer when moisture is added. In the nectaries of the peach, plum, and cherry blossoms the organism was found to live for 5 days or more and still remain capable of infecting trees. In the experiments with honey, a fresh sample of honey was inoculated with bacteria, and beginning 2 days later inoculations were made on apple shoots for a period of 9 days. In this experiment the maximum life of the organism in honey was found to exceed 72 hours, but from the evidence at hand it is not believed to live longer than 100 hours in this medium.

Longevity of Bacillus amylovorus, J. W. Hotson (*Abs. in Phytopathology, 6 (1916), No. 1, p. 115*).—An attempt has been made to determine the length of time the fire blight organism lives in infected branches after they have been cut from the trees.

It was found that the organism existing in branches, when exposed to direct sunlight, remains alive for from 10 to 13 days, and similar results were obtained when the exudate was present on the fruit. When the branches were shaded for part of the day the bacteria remained alive for 27 days in the bark, and when infected branches were left in a field where there was a cover crop of alfalfa, living bacteria were obtained in some cases 29 days after the limbs were cut.

Arsenate of lead as a fungicide for apple scab, W. J. Morse (*Abs. in Phytopathology, 6 (1916), No. 1, p. 118*).—In a series of spraying experiments covering four seasons, in which the Ben Davis variety of apples was used, satisfactory results are said to have been obtained where arsenate of lead was used alone or in combination with fungicides. The arsenate of lead produced little or no russeting of the fruit, and in three seasons out of four from 12 to 18 per cent more merchantable fruit was obtained than when lime-sulphur was employed.

Irrigation and bitter pit, C. Brooks and D. F. Fisher (*Abs. in Phytopathology, 6 (1916), No. 1, p. 111*).—Attention is called to the relation between the occurrence of corky bitter pit of apples and an increase in the amount of water used. Heavy irrigation throughout the entire season or medium irrigation until August followed by heavy irrigation resulted in a much greater amount of

bitter pit in case of Grimes Golden, Jonathan, and other varieties than medium or light irrigation throughout the season.

Blight-resistant roots—the first step toward pear blight control, A. L. Wisker (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 2, pp. 48–53, fig. 1*).—Experience in California with pear blight (*Bacillus amylovorus*) in the past two years is said to have emphasized the inability of orchardists alone to control this disease.

Comparisons are made as to adaptability for stocks of the French or wild European pear (*Pyrus communis*) and the Japan or wild Asiatic pear (*P. sinensis*). The latter is said to make the more vigorous growth, its seedlings are less subject to leaf blight (*Entomosporium maculatum*), its roots have little tendency to sucker, and it resists blight better, on the average, than any other root now in use. It makes vigorous growth with less soil moisture also than does the French pear, and trees grown on Japan root suffer comparatively little also from pear aphis. These and other claims are regarded, however, as somewhat tentative. It is admitted that under conditions of excessive soil saturation the Japan pear may be injured by root rot.

Further studies on plum wilt, B. B. Higgins (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 117, 118*).—In continuation of a previous report (E. S. R., 34, p. 747), the author claims that the fungus causing the plum wilt is a general wound parasite of woody plants but is not found occurring normally on any plant outside of the genus Prunus.

Summer sprays against American gooseberry mildew, B. T. P. Barker and A. H. Lees (*Jour. Bd. Agr. [London], 22 (1916), No. 12, pp. 1244–1249*).—The authors, summarizing the work done by them during the past two years on the summer treatment of American gooseberry mildew, state that their experience agrees with that of Eyre and Salmon (E. S. R., 35, p. 654), as regards the injurious effects of fungicidal concentrations of liver of sulphur as previously used in this connection. Trial has also been made of a combination not known to have been previously tested, consisting of a mixture of liver of sulphur and a soft soap and paraffin emulsion, which is said to have given the most promising results. How far the liver of sulphur furnishes the fungicidal factor is not known, but it is thought that all the ingredients may be required for the full effect. The primary object of this paper is to call this mixture to the attention of other investigators.

It was found that what are called hitting or contact sprays, designed to kill the mycelium and conidia already on the bush, were rendered more or less ineffective by the presence of air between the conidiophores and the conidia. In a series of tests of protective or cover sprays, employing such fungicides as Bordeaux mixture or lime sulphur, no entirely satisfactory results were obtained, as the mildew reappeared, although in slight degree. The cost of treatment and other details are discussed.

[Fungus diseases of the cranberry], H. J. Franklin (*Massachusetts Sta. Bul. 168 (1916), pp. 1–5*).—A report is given of studies carried on on the fungus diseases of cranberries, the work having been done in cooperation with the Bureau of Plant Industry of this Department.

Spraying experiments were conducted with Bordeaux mixture, and the results obtained are similar to those previously reported (E. S. R., 33, p. 350). The sprayed plats yielded less fruit than the untreated checks, although the keeping quality of the sprayed berries was somewhat better than the unsprayed ones. However, berries from plats that had been treated in previous years but not in 1915 showed poorer keeping quality than those which had not been sprayed.

An experiment in controlling fungus diseases by putting copper sulphate in the flowage water was carried out, but the results show no advantage in favor of the treatment. In storage, however, the berries from the treated sections showed smaller percentages of rot than those from other sections.

An investigation of cranberry bogs in New Jersey, where treatment was being made for control of plant diseases, did not reveal any such injury as that caused by spraying tests in Massachusetts. No definite reason for this difference is evident, although it is thought that it may possibly be connected in some way with the use of sand as a mulch in Massachuetts.

The disease known as Wisconsin false blossom is reported on several varieties, and evidence seems to be accumulating that in some way the disease is infectious.

A new disease called blossom end rot in previous reports was more prevalent than usual. The investigation of the fungus causing this disease is being continued.

Eradication on a large scale, E. NELSON (*Abs. in Phytopathology, 6 (1916), No. 1, p. 114*).—A description is given of the attempt being made in Florida to eradicate the citrus canker due to *Pseudomonas citri*. The method employed is to destroy with fire the infected trees, these being sprayed with kerosene mixed with crude oil.

Diseases of plants caused by nematodes, G. P. CLINTON (*Connecticut State Sta. Rpt. 1915, pt. 6, pp. 452–462, pls. 2*).—After a brief account of the occurrence and injurious action of *Heterodera radicicola*, the author describes a leaf blight nematode (*Aphelenchus olesistus*) as attacking begonias and ferns in greenhouses.

Cutting out chestnut blighted timber, E. M. STODDARD and A. E. MOSS (*Connecticut State Sta. Rpt. 1915, pt. 6, pp. 488–496, pls. 2, fig. 1*).—In order to determine whether the spread of chestnut blight could be retarded or checked by the removal each year of infected trees, and if so, whether the work is economically possible, the authors carried on experiments on 130 acres, on which every winter all infected chestnut trees were removed, and for comparison the infected trees on an adjoining 190 acres were counted but not removed.

As a result of this investigation, it was found that in Connecticut the cutting and removing from woodlots of trees infected with chestnut blight did not prevent the spread of the disease. The cost of inspection, cutting, and removing is considered too high to warrant its adoption from a commercial standpoint.

A Glœosporium on horse-chestnut shoots, J. F. ADAMS (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 114, 115*).—A blighting of the terminal shoots of the horse-chestnut, due to a species of Glœosporium, is described. Inoculation experiments with this fungus on apple have produced conditions similar to those produced by *Glomerella cingulata*.

Leaf fall of conifers, F. W. NEGER and J. FUCHS (*Jahrb. Wiss. Bot. [Pringsheim], 55 (1915), No. 4, pp. 608–660, figs. 22*).—The authors have studied leaf separation and frost killing in certain conifers.

Leaf cast is most commonly due directly to water loss. The forms or processes of separation peculiar to different conifers are described. Frost killing of evergreen foliage appears to be a special case of late frost injury and to have its origin in the untimely awakening of the young needles in spring. The reddening often noted is a post mortem effect having no causal connection with the death of the foliage. It follows exposure to full sunlight of killed needles which still have a high content of water and acid.

Tipburn in white pine, G. P. BURNS (*Abs. in Phytopathology, 6 (1916), No. 1, p. 116*).—A form of tipburn occurring in the forest nursery of the State For-

estry Department of Vermont is reported, in which it appears that the velocity of the wind is the deciding factor in killing the young leaves.

Eradication of Cronartium ribicola from European pine plantings in New York State, W. H. RANKIN (*Abs. in Phytopathology, 6 (1916), No. 1, p. 114*).—A report is given on the white pine blister rust in plantings of white pine made from seedlings imported from Europe.

ENTOMOLOGY.

[Report of the] department of entomology, S. B. DOTEN (*Nevada Sta. Rpt. 1915, pp. 38–41, figs. 5*).—A brief summary is given of the work of the year in which the author was assisted by G. G. Schweis.

The conclusion is reached from work with hymenopterous parasites of the codling moth that it is not practical to check the pest by this means.

Reference is made to two papers published during the course of the year relative to a method of photographing living insects.[1]

Two cutworms which are said to have caused considerable injury to alfalfa are the desert cutworm (*Euxoa ridingsiana*) and the variegated cutworm. The former has been found in central and eastern Nevada in the spring feeding in such numbers upon the young shoots of alfalfa that the plant fails to make any growth, while the latter has been found in midsummer injuring the second crop in the same way. The experimental drowning of cutworms is briefly touched upon. Hogs, chickens, and turkeys are shown to consume large numbers of the pest.

With a view to determining the effect of cold and starvation upon the bedbug, 31 were placed in tubes in a box and kept under shelter in the open air from January 21 to April 10, with the result that only 11 remained alive and vigorous. These 11 were alive also on July 1 after having been put in tubes in a tin box, packed in cotton, and stored in a refrigerator at a temperature maintained constantly between 40 and 50° F. A number of bedbugs just hatched from the egg survived after having been kept for nearly three months in cold storage without food. Eggs kept under the same conditions hatched promptly when the temperature was raised. The results of experiments with sulphur fumigation seem to indicate that the eggs of bedbugs are not always killed and that two fumigations, a week apart in warm weather, are necessry to eradicate the pest.

The study of a disease of mature bees which made its appearance in 1915 indicates that it is the so-called Isle of Wight disease, due to *Nosema apis*.

An attempt to redefine the host relationships exhibited by entomophagous insects, H. S. SMITH (*Jour. Econ. Ent., 9 (1916), No. 5, pp. 477–486*).—The author redefines the old terms now in use with a view to standardizing the terminology of insect parasitism.

Sprays and spraying, F. B. PADDOCK (*Texas Sta. Bul. 187 (1916), pp. 5–36, fig. 8*).—A brief discussion of the several classes of insects is followed by an extended account of the various insecticides and means for their application. Preventive measures are also considered and a list with addresses is given of manufacturers and dealers in insecticides and spraying machinery.

Cost of dusting and spraying a New York apple orchard, C. R. CROSBY (*Jour. Econ. Ent., 9 (1916), No. 3, pp. 375, 376*).—The author presents data furnished by W. A. Crandall relative to a 21-acre orchard, containing about 625 trees ranging in age from 35 to 40 years, which was sprayed in 1913 and 1914 and dusted in 1915. Records of the cost of spraying in 1913 and 1914 and of dusting in 1915 presented in tabular form show the spraying to cost about

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[1] A "Cold" Flame for Zoological Work (*Camera Craft*, 1914, October); Flashlights of Living Insects (*Camera Craft*, 1915, April).

one-half more than dusting. Reports of extensive observations of the relative efficiency of dusting and spraying by the Cornell Experiment Station have been previously noted (E. S. R., 34, p. 738).

[Work with cranberry insects in 1915], H. J. FRANKLIN (*Massachusetts Sta. Bul. 168 (1916), pp. 31–43*).—In referring to the loss caused by cranberry insects during the year it is stated that that due to the fruit worm was considerably more than in 1913 and 1914 but not as great as in some years. A spanworm (*Abbotana clemataria*), commonly observed on cranberry bogs in July, was reared successfully, the moths emerging between May 20 and 27 from pupæ formed between July 9 and 25 of the previous year. A batch of 432 eggs was deposited by one of the reared moths about May 30, caterpillars emerging therefrom on June 14. Pupation is said to take place at a maximum depth of 2 in. in the sand of breeding cans. While common on the bogs this insect has not appeared in sufficient numbers to do any considerable injury.

An ichneumonid parasite (*Amblyteles putus*) was reared during the year in small numbers from the green spanworm (*Cymatophora sulphurea*), commonly found late in May eating holes in the winter buds at the tips of the uprights. An infestation by what appeared to be the cranberry rootworm (*Rhabdopterus picipes*) was discovered in October on a bog at Wareham, some two acres having shown more or less injury. In an examination of a bog in South Carver it was found that a small beetle (*Cryptocephalus incertus*), present in great numbers, was devouring the foliage. It is pointed out that there are four ways in which a bog may become infested with the gipsy moth.

Records of the amount of the cranberry tip worm (*Cecidomyia oxycoccana*) injury on 14 different bogs in 1914–15 and the effect of resanding are presented in tabular form. There was not a single bog, a record of the 1914 examination of which was kept, that after being resanded did not show a tremendous drop in the amount of tip worm infestation. On the other hand, practically only one bog that had not been resanded between September, 1914, and May, 1915, failed to show an infestation equal to or greater than that of 1914.

No advantage was obtained from the sweetening of arsenical sprays with saccharine in use against the black-head fire worm (*Rhopobota vacciniana*). A heavy infestation by this pest on a bog at Wareham was greatly reduced by the holding of a partial flowage until the first of July.

In experimental work with the cranberry fruit worm (*Mineola vaccinii*), two netting sacks, each containing 160 cocoons, were submerged in a pond in 3 ft. of water on January 15. One of the sacks which was taken from the water on March 31 showed 40 per cent of the worms therein to be alive, almost a quarter of them being quite active. Those in the second sack which was removed from the water on May 20 were all found dead and most of them more or less decomposed. The percentage of parasitism of this pest was considerably higher than that of the previous year. Parasitism by *Phanerotoma tibialis* ranged from 27 to 72 per cent on dry bogs and from almost none to about 22 per cent on bogs that had the winter flowage held late. Parasitism by *Pristomeridia agilis* ranged from 5 to about 38 per cent in fruit worms taken from dry bogs and from none to about 7.5 in those from bogs that had the winter flowage held late. The eggs of the fruit worm showed a range in parasitism by *Trichogramma minuta* from 42 to about 89 per cent on dry bogs and from about 12 to 89 per cent on those with winter flowage. It is estimated that the predacious and parasitic enemies of the fruit worm destroy not less than 97 per cent on some dry bogs and close to 90 per cent on some flowed bogs.

Gonepteryx rhamni and Castnia therapon in New Jersey, H. B. WEISS (*Jour. Econ. Ent., 9 (1916), No. 3, p. 378*).—An almost perfect female of *G. rhamni*, known as the brimstone butterfly, was taken from a case of French

shrubs at Rutherford, N. J., having apparently emerged en route. A larva of the lepidopteran *C. therapon* was found in a greenhouse at Bound Brook, N. J., infesting orchids which originally came from Pernambuco.

Grasshopper control, D. E. MERRILL (*New Mexico Sta. Bul. 102 (1916), pp. 32, figs. 19*).—This is a discussion of the grasshopper problem in New Mexico, in every part of which State damage is liable to take place. Mention is made of seven species as sources of injury, namely, *Melanoplus differentialis, M. bivittatus, M. atlanis, M. femur-rubrum, Hadrotettix trifasciatus, Schistocerca venusta*, and *Brachystola magna*, of which the first three are the most important. The greatest injury is caused to alfalfa, garden and truck crops, grains, and young fruit trees.

Their control is deemed practicable through the destruction of breeding places and eggs and of the grasshoppers by poisoning or by capture with machines for that purpose.

Notes on Anasa andresii, an enemy of cucurbits, T. H. JONES (*Jour. Econ. Ent., 9 (1916), No. 4, pp. 431–434*).—Preliminary notes on the biology of *A. andresii*, based on observations made by the author and C. E. Smith at Baton Rouge, La., during 1915, are presented. The species is also known to occur in Florida, Texas, New Mexico, central Mexico, and Cuba. Its injury is similar to that caused by *A. tristis*.

Triphleps insidiosus as the probable transmitter of corn-ear rot (Diplodia sp., Fusarium sp.), J. A. HYSLOP (*Jour. Econ. Ent., 9 (1916), No. 4, pp. 435–438*).—A report of observations made at New Paris, Me., in the fall of 1912. The form of ear rot caused by *Bacterium stewarti* was a source of severe injury to sweet corn in the large corn-canning districts of the State.

Some unpublished notes on Pemphigus betæ, A. C. MAXSON (*Jour. Econ. Ent., 9 (1916), No. 5, pp. 500–504*).—This is a report of observations on the biology of the sugar beet root louse at Longmont, Colo., by the author, conducted in cooperation with the Colorado Experiment Station.

Dispersion of scale insects by the wind, H. J. QUAYLE (*Jour. Econ. Ent., 9 (1916), No. 5, pp. 486–493, fig. 1*).—In work at the Citrus Substation at Riverside, Cal., the author found young black scales to be carried by the wind as far as 450 feet, the greatest distance at which tanglefoot sheets were set. The young of the red scale were captured on such sheets at distances ranging from 30 to 150 feet.

Reducing the cost of commercial spraying, R. S. WOGLUM (*Jour. Econ. Ent., 9 (1916), No. 4, pp. 392–395, fig. 1*).—The author describes and presents a diagram of a pipe system in a 10-acre orange orchard in southern California, in which the cost of applications of water under high pressure for the control of mealy bugs was found to average 75 per cent less than where the work was done by means of a portable sprayer alone.

The white-marked tussock moth (Hemerocampa leucostigma), H. C. YINGLING (*Mo. Bul. Ohio Sta., 1 (1916), No. 9, pp. 265–270, figs. 3*).—A popular account of this moth, which is one of the most important insect enemies of shade and ornamental trees in many cities in Ohio.

The New Mexico range caterpillar and its control, V. L. WILDERMUTH and D. J. CAFFREY (*U. S. Dept. Agr. Bul. 443 (1916), pp. 12, figs. 12*).—This is a report of work with *Hemileuca olivæ* commenced at Koehler, N. Mex., in 1913, and carried on in continuation of that by Ainslie, as previously noted (E. S. R., 23, p. 463). Its life history and natural enemies have been given particular attention.

The pest is said to be of economic importance only in the five counties in the northeastern corner of the State, but a scattering infestation occurs across

the line in Texas and two colonies were found during 1915 in southern New Mexico. Many cultivated crops are now attacked in addition to range grasses. The authors conclude that its present destructive abundance is due to the reduction in numbers of its natural enemies through some severe climatic condition.

The introduction of natural enemies appears to be the only practical measure in control work on the range. As a result of this work a number of insect enemies of the pest appear to have become established. The native natural enemies also are now beginning to assert themselves again.

The small pink corn worm (Batrachedra rileyi) in Mississippi, R. W. HARNED (*Jour. Econ. Ent., 9 (1916), No. 2, pp. 295–298, figs. 2*).—This pest, an account of which by Chittenden has been previously noted (E. S. R., 35, p. 256), attracted more attention during the previous 14 months than any other occurring in Mississippi. During November and December, 1914, hundreds of complaints in regard to the work of this insect in stored corn were received, most of which came from the central part of the State.

Control of the variegated cutworm in Ventura County, California, G. E. BENSEL (*Jour. Econ. Ent., 9 (1916), No. 2, pp. 303–306, pls. 3*).—The variegated cutworm is widely distributed in Ventura County, Cal., where it has done considerable damage to the sugar beet crop since April, 1913, when the first serious outbreak occurred. The methods of control mentioned include application of arsenicals, ditching, and trapping the moths by lights.

A coccid-feeding moth, (Blastobasis) Holcocera iceryæella, E. O. ESSIG (*Jour. Econ. Ent., 9 (1916), No. 3, pp. 369, 370, pl. 1*).—In addition to the black scale and cottony cushion scale recorded by Riley as hosts of this moth, the author has found the European peach scale (*Lecanium persicæ*), the greedy scale (*Aspidiotus camelliæ*), and Baker's mealy bug (*Pseudococcus bakeri*) to serve as hosts at Berkeley, Cal.

Additional notes on the use of dust sprays against the corn-ear worm, J. W. MCCOLLOCH (*Jour. Econ. Ent., 9 (1916), No. 4, pp. 395–398*).—Further work by the author (E. S. R., 34, p. 63) has led to the following conclusions:

"The percentage of corn-ear worm and mold injury decreases as the number of dustings are increased. The cost of dusting is prohibitive where corn is grown for grain or forage but is practical where corn is raised for roasting ears, show purposes, or for seed corn. Sulphur is superior to flour or lime as a carrier for arsenate of lead and there is some indication that it also serves as a fungicide. Fifty per cent arsenate of lead does not control the corn-ear worm so effectively as does 75 per cent arsenate of lead."

Bucculatrix thurberiella, a pest of cotton in the Imperial Valley, E. A. MCGREGOR (*Jour. Econ. Ent., 9 (1916), No. 5, pp. 505–510, pls. 2*).—The larvæ of this tineid moth were found in June, 1916, devouring the leaves of cotton in fields in eight localities in the Imperial Valley, Cal., indicating that it occurs in every cultivated part of the valley. It was found in every cotton field examined and in some fields every leaf was attacked by it.

Economic Syrphidæ in California, W. M. DAVIDSON (*Jour. Econ. Ent., 9 (1916), No. 5, pp. 454–457*).—A brief discussion of the syrphus flies of economic importance in California.

Dispersion of Musca domestica under city conditions in Montana, R. R. PARKER (*Jour. Econ. Ent., 9 (1916), No. 3, pp. 325–354, pls. 4*).—This is a detailed report of dispersion studies carried on in Miles City, Mont., during the season of 1915. In that city, the built-up portion of which is about 1.5 miles square, 387,877 marked flies were liberated from four release points. Of these a total of 1,056 were recaptured at 78 stations which varied from 50 to 3,500

yds. from the point of release, the latter being the greatest distance at which recaptures were attempted.

"The full possibilities of dispersion were not determined, due to the relatively small size of the city, but the fact that flies spread from release points on one border to points on the opposite side indicates a possible radius of 2,333 yds. (1⅓ miles), and that flies even traversed the entire city and crossed open country to points beyond justifies the belief in a still greater radius. The actual territory over which flies were recovered in the city was about 2 square miles, but possible dispersion over a territory of from 5 to more than 12 square miles was indicated."

A bibliography of 11 titles is appended.

Some observations on the breeding habits of the common house fly (Musca domestica), A. T. EVANS (*Jour. Econ. Ent., 9 (1916), No. 3, pp. 354–362, pls. 3*).—The author reports experiments carried on during the summer of 1915. With a single exception, no larvæ of the house fly were found breeding in garbage.

Sarcophagidæ of New England: Genus Sarcophaga, R. R. PARKER (*Jour. Econ. Ent., 9 (1916), No. 4, pp. 438–441, fig. 1*).—A new species, the occurrence of which in abundance was limited to the presence of larvæ of either the gipsy moth or forest tent caterpillar, especially the latter, is described as *Sarcophaga aldrichi*. The status of this species in the economy of nature remains to be determined.

Notes on Pegomya hyoscyami, E. N. CORY (*Jour. Econ. Ent., 9 (1916), No. 3, pp. 372–375, fig. 1*).—The author reared this dipterous leaf miner from lamb's quarters (*Chenopodium album*), spinach (*Spinacia oleracea*), and pigweed (*Amarantus retroflexus*) in Maryland, and presents observations on its biology. The parasite *Opius foveolatus* was reared from nearly every lot of miners. Studies of this insect by Cameron in England have been previously noted (E. S. R., 32, p. 351).

The columbine leaf miner, E. N. CORY (*Jour. Econ. Ent., 9 (1916), No. 4, pp. 419–424, pl. 1, figs. 2*).—A report of biological studies at the Maryland Experiment Station of *Phytomyza aquilegiæ*, which mines the leaves of *Aquilegia* spp.

Injury to peanuts by the twelve-spotted cucumber beetle (Diabrotica 12-punctata), D. E. FINK (*Jour. Econ. Ent., 9 (1916), No. 3, pp. 366–368, pl. 1*).—The author has found that peanut pods, particularly when still young and soft, are subject to serious injury by the larva of this beetle. Rotation and vigorous growing crops are decided factors in controlling or keeping the crop free from attack by this pest.

Lachnosterna larvæ as a possible food supply, L. O. HOWARD (*Jour. Econ. Ent., 9 (1916), No. 4, pp. 389–392*).

A note on the predacious habits of Dineutes ("whirligig beetles") toward Anopheles larvæ, R. C. DERIVAUX (*Pub. Health Rpts. [U. S.], 31 (1916), No. 20, pp. 1228–1230*).—The author's observations have led to the inference that, while capable of swift destruction of Anopheles larvæ under experimental conditions and in the absence of protecting vegetation and flotage, Dineutes alone are not of sufficient efficacy as natural enemies to justify considering waters inhabited by them as free of dangerous potentialities as Anopheles breeding places. "Under natural conditions, their influence on Anopheles propagation is of but small practical importance."

The eggplant tortoise beetle, T. H. JONES (*U. S. Dept. Agr. Bul. 422 (1916), pp. 8, figs. 3*).—In the spring of 1915 the larvæ of *Cassida pallidula* were a source of injury to the foliage of eggplant and Irish potatoes at Baton Rouge, La. During that year studies were made of its biology and experiments con-

ducted with insecticides. Various wild solanums also serve as food plants for the species, which is quite widely distributed over the more southern portions of the United States.

In the laboratory over 200 eggs were deposited by a single female, 12 being laid in one day. They are largely placed upon the underside of the leaves but may be found on other parts of the plant. In June a period of from 4 to 5 days was required for their incubation. The five larval instars of 43 individuals observed required from 12 to 20 days for development during June and July. During these months the pupal period occupied from 2 to 7 days. The winter is passed in the adult stage. It is pointed out that under favorable conditions five generations may develop during the year at Baton Rouge.

Experiments with lead arsenate and zinc arsenite indicate that the pest can be kept under control through the use of arsenicals.

The fruit-tree leaf Syneta, spraying data, and biological notes, G. F. Moznette (*Jour. Econ. Ent., 9 (1916), No. 5, pp. 458–461, pls. 2*).—*Syneta albida* is said to have been the source of considerable injury to prunes and cherries in the Willamette Valley of Oregon in the spring of 1916.

The reflex "bleeding" of the coccinellid beetle, Epilachna borealis, N. E. McIndoo (*Ann. Ent. Soc. Amer., 9 (1916), No. 2, pp. 201–223, figs. 21*).

Notes on the habits of a dangerous genus of weevils, W. D. Pierce (*Jour. Econ. Ent., 9 (1916), No. 4, pp. 424–431, figs. 4*).—This paper deals with weevils of the genus Polydrusus. Two European species have recently been found in the United States and four other species are apparently native or have been long established in this country.

The imported poplar root weevil (*P. impressifrons*) is already doing considerable damage in New York and Connecticut. The author gives descriptions of its several stages and includes notes by Parrott on its habits in New York State. The imported fruit-bud weevil (*P. sericeus*), two speciments of which have been collected in Marion County, Ind., is in Italy quite injurious as an adult to the buds and foliage of fruit trees, especially the pear.

Sporotrichum globuliferum, a natural enemy of the alfalfa weevil, L. P. Rockwood (*Jour. Econ. Ent., 9 (1916), No. 5, pp. 493–499*).—This entomogenous fungus is said to develop spontaneously as an infectious disease of the alfalfa weevil on the bench lands of the Salt Lake Valley, in the early spring. Laboratory experiments are reported.

Report from the division of bees for the fiscal year ended March 31, 1915, F. W. L. Sladen et al. (*Canada Expt. Farms Rpts. 1915, pp. 991–1014, pls. 3*).—The work of the year at the Central Experimental Farm at Ottawa and at the branch stations is first reported upon in a general way by the apiarist, F. W. L. Sladen (pp. 993–996), who touches upon a number of problems that confront the beekeeper in Canada. It has been demonstrated that bees can be kept at all of the farms and stations, though losses of bees, sometimes heavy, have occurred during the winter. A considerable measure of success has been met with in the wintering of bees outdoors at Ottawa in cases packed with insulating material and sheltered from the wind. Attempts at wintering in this manner at several of the stations are said to warrant a further trial. Investigation has shown, with the possible exception of the farms on the prairie and in the dry belt of British Columbia, that the bulk of the surplus honey is generally gathered from less than one-half dozen species of plants and in some cases from only two or three, the quality of the honey from these plants being excellent. A change to Italian bees in 1910 at the Central Farm, in order to control the European foul brood, resulted not only in the suppression of the disease but in a substantial increase of the honey crop.

The report of the apiarist of the Central Farm (pp. 997–1000) summarizes the wintering results of 1913–14 and 1914–15, reports upon the honey crop of 1914, and describes the type of hive used. Thirty-seven colonies placed in a cellar on November 10, 1913, averaged a loss in weight of 14.4 lbs., the greatest loss being 27 lbs., and with the 16 colonies protected outdoors the average weight loss was 22.5 lbs. and the greatest loss 35 lbs. In 1913–14 the last good flight before winter was on November 22, at a temperature of 63°, and the first extensive spring flight was on March 16, at a temperature of 50°. In 1914–15 the last flight before winter occurred on November 26, at a temperature of 45°, and the first spring flight was on March 23, at a temperature of 45.5°. The total honey crop in 1914 was 2,348 lbs. of extracted honey and 69 sections of comb honey. The extracted honey consisted of 120 lbs. of dandelion honey gathered in May, 1,675 lbs. of white honey gathered during June and July, and 553 lbs. of amber-colored honey gathered at the end of July and in August. The largest yield from a single colony was 257 lbs. of extracted honey, from a colony that had wintered outside. A table is given which shows the average loss or gain in weight of a colony during successive periods of about ten days during the season, with the principal sources from which the honey was gathered. Experience has shown that the 8-frame brood chamber does not supply sufficient breeding space, but that a 10-frame brood chamber is usually large enough to accommodate all, or nearly all, of the brood.

Reports of the superintendents on the bee work at the experimental farms follow (pp. 1001–1014).

Detection of arsenic in bees, E. B. HOLLAND (*Jour. Econ. Ent.*, *9* (*1916*), *No. 3*, *pp. 364–366*).—A preliminary report of work at the Massachusetts Experiment Station, in which 12 out of 23 samples of affected bees were found to contain a small amount of arsenic.

Professor Gossard's theory on fire blight transmission, E. F. PHILLIPS (*Jour. Econ. Ent.*, *9* (*1916*), *No. 3*, *pp. 362, 363*).—In reviewing the paper by Gossard previously noted (E. S. R., 35, p. 662), the author calls attention to the lack of experimental data supporting the view that *Bacillus amylovorus* is transmitted by the honeybee.

The chrysanthemum gall fly, Diarthronomyia hypogæa, E. O. ESSIG (*Jour. Econ. Ent.*, *9* (*1916*), *No. 5*, *pp. 461–468*, *pls. 2*, *figs. 3*).—In a general survey of the central part of the State, made by the author, this gall fly was found quite abundant and destructive in the region of San Francisco Bay, where it has been known to flourish for over 15 years. It causes cone-shaped galls on the leaves, leaf-petioles, stems, and buds. Infested shoots are often distorted and are eventually killed. The growing of the crop under cloth is the most efficient and satisfactory means for preventing this injury.

A new species of Isosoma attacking wheat in Utah, R. W. DOANE (*Jour. Econ. Ent.*, *9* (*1916*), *No. 4*, *pp. 398–401*, *pl. 1*, *fig. 1*).—During the course of investigations conducted in the so-called dry farm regions in the Salt Lake Valley, the author collected two species of Isosoma. One of these was the well-known wheat straw worm (*I. grande*), the other a new species, here described as *I. vaginicolum*, which he terms the wheat sheath worm, as the larvæ confine their attacks to the leaf sheath. The swelling and hardening of the walls of the sheath which results from their attack presses on the stem in such a way as to prevent the sap from flowing through it readily, and the plants become stunted and produce only small, poorly developed heads. Some fields observed were so badly injured that they were not considered worth harvesting, and the whole crop was a total loss. This new species has been found only in the dry farm region.

Descriptions of and observations on some chalcidoid Hymenoptera, A. A. GIRAULT (*Canad. Ent., 48 (1916), No. 7, pp. 242–246*).

An egg parasite of the army worm (Heliophila unipuncta), W. P. FLINT (*Jour. Econ. Ent., 9 (1916), No. 3, p. 377*).—A chalcidid parasite reared from the eggs of the army worm in the vicinity of Springfield, Ill., has been determined to be a species of Telenomus.

Notes on Rhogas terminalis, W. E. PENNINGTON (*Jour. Econ. Ent., 9 (1916), No. 4, pp. 401–406, pl. 1, fig. 1*).—This paper deals with observations on *R. terminalis*, a braconid parasite of the army worm, made at Hagerstown, Md.

In that region there appear to be four complete generations annually, with a possibility of a maximum of six generations. The parasite is present throughout the entire active season of its host and hibernates in the puparium stage. It oviposits only in second and third instar host larvæ.

Breeding fruit fly parasites in the Hawaiian Islands, J. G. BRIDWELL (*Jour. Econ. Ent., 9 (1916), No. 5, pp. 472–477*).—This reports upon breeding work in Hawaii with introduced parasites.

Municipal control of the Argentine ant, E. R. DE ONG (*Jour. Econ. Ent., 9 (1916), No. 5, pp. 468–472*).—This ant, first recognized in California in 1908 at only eight points, has since spread to most of the larger cities on the coast. In the present paper the author describes the control measures made use of.

FOODS—HUMAN NUTRITION.

The vegetarian diet in the light of our present knowledge of nutrition, E. V. MCCOLLUM, N. SIMMONDS, and W. PITZ (*Amer. Jour. Physiol., 41 (1916), No. 3, pp. 333–360, pl. 1, figs. 19*).—This article discusses the vegetarian diet in the light of extensive experiments carried out at the Wisconsin Experiment Station, in which restricted diets have been fed to several species of laboratory and other animals.

Attention is called to the fact that little confidence can be placed on the results of human experience with vegetarian diets because of the frequent consumption of foods prepared with milk, eggs, and butter, and the use of soups, gravies, etc., which include extracts of fats of animal origin. Although experience shows that grazing animals grow from a comparatively early age if fed entirely on food derived from plants, the authors state that they have not found "convincing evidence that any mammal has been adequately nourished from weaning time by a mixture of the seeds of plants and has made the maximum amount of growth and at the maximum possible rate."

The results of work by other investigators on the adequacy of a vegetarian diet for growth and maintenance are reviewed, and the authors reproduce a number of charts from their own experiments showing the growth of laboratory animals (rats) when fed upon different vegetarian diets.

Reference is made to earlier work by the senior author and others, in which the fact was established that, in addition to purified protein, carbohydrate, fat, and salt mixtures, there must be supplied two dietary factors whose chemical natures are at present unknown. These factors are referred to as fat-soluble A and water-soluble B, rather than denoted by the indefinite term "vitamin."

With reference to polyneuritis in pigeons, induced by diets of polished rice or purified foodstuffs, the authors state that they are convinced that "all the observed pathological phenomena can be accounted for in maladjustments relating to the following factors: The inorganic constituents; poor quality and inadequate quantity of the protein content; shortage of the substances A or B, or of both of them, and in certain cases the presence of toxic constituents in

the natural foodstuffs. The latter may be of either inorganic or organic nature. Aluminum and colloidal silica in the one class have been suggested and gossypol of the cottonseed, and the toxic effect of the oil of the wheat kernel which . . . [were] recently described may be cited as examples of the second."

Methods of experimentation, which enable the isolation of individual dietary factors and the evaluation of the individual dietary components in any natural foodstuff, have been described in the present and former papers. They have shown how the degree in which the shortcomings of one natural foodstuff are corrected by the supplementary character of another can be studied by biological methods sufficiently sensitive to yield results of great practical value.

The authors state that the "practically complete success in the nutrition of rats with strictly vegetarian diets made up of but three natural foodstuffs, and the failure attending the employment of a wider variety in the food mixture, emphasizes the fallacy of the assumption that the safest plan to insure perfect nutrition is to include a wide variety in the selection of the constituents of the diet. So long as definite knowledge is wanting concerning the specific nutritive properties of the constituents of the diet, variety will unquestionably make for safety, but will not by any means assure safety, and indeed can scarcely secure the optimum result in any considerable percentage of cases." As soon as an adequate knowledge of the specific properties of the natural foodstuffs and their supplementary relations to each other is possessed, it will be possible to compound fairly simple and monotonous diets which can be depended upon to induce physiological well-being closely approximating the optimum.

"The conscientious adherence to a vegetarian diet by one who has no adequate technical knowledge regarding the subject of diet appears to be fraught with danger, since among the foods of vegetable origin ordinarily consumed by human beings several dietary factors are as a rule of an unsatisfactory chemical character. It is certain that all of the components of a successful diet are present in foods of plant origin."

The distribution in plants of the fat-soluble A, the dietary essential of butter fat, E. V. McCollum, N. Simmonds, and W. Pitz (*Amer. Jour. Physiol., 41 (1916), No. 3, pp. 361–375, pl. 1, figs. 11*).—To determine whether the indispensable dietary factor, fat-soluble A, is present in foods of vegetable origin or is a specific product of the mammary gland and the ovary of birds, various types of substances of plant origin were fed with rations made up so as to be wholly adequate when one of the growth-promoting foods was included but in adequate when such foods were omitted. Records are given of the growth of laboratory animals (rats), which were fed upon rations in which maize, cottonseed, linseed, olive, sunflower-seed, and soy-bean oils, respectively, were the only source of the dietary factor contained in butter fat. The results of these experiments showed that the fat-soluble A is not found in fats and oils of plant origin.

Rats consuming cotton-seed oil prepared by ether extraction suffered intoxication within a few weeks and showed rapid loss of weight, but the commercial bleached oil, prepared by hot pressing, could be fed at the same plane of intake with no signs of injury. This corroborates the observations of other investigators that the toxic factor "gossypol" is soluble in ether and is present in the fat prepared by the use of this solvent. By feeding rations which made it possible to test for toxicity of low intensity, the authors found that wheat oil, linseed oil, and hydrogenated cotton-seed oil showed definite but not severe toxic effects on young rats.

It was observed in the experiments here reported that "ether extraction of plant tissue does not remove the substance essential for growth which is contained in butter fat. The obvious working hypothesis must for the present

assume that the fat-soluble A is in chemical union in the plant tissues and in a complex which is not soluble in fat or in ether. In digestion and absorption it is set free and, being readily soluble in fats, thereafter accompanies the fats in the animal body."

The relation of the unidentified dietary factors, the fat-soluble A and water-soluble B, of the diet to the growth-promoting properties of milk, E. V. McCollum, N. Simmonds, and W. Pitz (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 33–43, figs. 6*).—Experiments with laboratory animals (rats) were carried out to determine the ability of normal female rats to nourish their young when confined to a diet known to be adequate for growth when satisfactory amounts of the dietary essentials, fat-soluble A and water-soluble B, are added, and inadequate for growth when either of these factors is omitted.

Female rats were fed a ration of natural foodstuffs until their young were delivered. The litter in all cases was reduced to four and several series of experiments conducted in which the basal ration consisted of purified casein, dextrin, inorganic salts, and agar-agar. This was adequate for growth except for the absence of the dietary factors, fat-soluble A and water-soluble B. In a second series of experiments butter fat containing fat-soluble A was added to the basal ration. In another, water-soluble B was added in the form of an alcoholic extract of wheat embryo, and in still another series both fat-soluble A and water-soluble B were added. Charts are given which show the rate of growth of the young animals and the weight of the nursing mothers receiving these rations.

It is concluded from these experiments that these two constituents of the diet (fat-soluble A and water-soluble B) "pass into the milk only as they are present in the diet of the mother, and that milks may vary in their growth-promoting power when the diets of the lactating animals differ widely in their satisfactoriness for the growth of young. . . .

"The chemical natures of the fat-soluble A and water-soluble B, whether these represent in each case a single substance or a group of substances, are of such a character that they can not be formed within the animal body from any of the cleavage products of proteins."

Studies on experimental scurvy in guinea pigs, Leila Jackson and J. J. Moore (*Jour. Infect. Diseases, 19 (1916), No. 3, pp. 478–510, figs. 14*).—These experiments were undertaken as the result of a disease noted among the laboratory guinea pigs maintained upon a diet which, in addition to oats, green vegetables, hay, and water, consisted largely of milk from a cow having experimental streptococcal mastitis. To determine the factors in the diet responsible for the disease, groups of the laboratory animals were fed upon various combinations of food. The diets tested included commercially pasteurized market milk; raw milk; boiled milk; milk and streptococcus broth; streptococcus broth; water and hay; carrots, cabbage, and hay; milk, vegetables, and oats; skim milk; cream; milk and olive oil; lactose water and hay; limewater; casein and hay; condensed milk; thyroid extract, milk, and hay; hay and oats, bread, or bran; milk and oats; and goat's milk. The results of the investigation are summarized in part as follows:

"Experimental scurvy was produced in guinea pigs by diets of pasteurized, raw, boiled, skimmed, and condensed milk, streptococcus broth and milk, milk and green vegetables, thyroid extract and milk, casein and water, oats, bread, and bran. The addition of calcium lactate to milk or the injection of calcium lactate into guinea pigs on a milk diet did not prevent scurvy. A cream diet, and a diet of olive oil added to milk, produced a 'fat constipation' with early death. Daily injections of olive oil into animals on a milk diet had no antiscorbutic effect.

"Mixed broth cultures of *Streptococcus viridans* and *Streptococcus hemolyticus*, water, lactose water, and limewater did not produce scurvy. In a series of six guinea pigs fed on goat's milk for over 40 days, no symptoms of scurvy developed. . . .

"The average time for the onset of symptoms with pasteurized milk was 19 days. With other milk diets this varied from 11 to 19 days. The earliest lesion was observed on the tenth, the latest on the twenty-ninth day."

The lesions produced by the disease, as shown by histological examination of post-mortem material, are described in detail.

The salicylic acid reaction of beans, H. C. BRILL (*Philippine Jour. Sci., Sect. A, 11 (1916), No. 2, pp. 81–89*).—This article summarizes information regarding the nutritive value of different sorts of beans.

Tests were made of a number of samples of Philippine, Japanese, Chinese, and American beans and several breakfast foods and coffee substitutes to determine their reaction to the ferric chlorid test for salicylic acid. The soy beans were found to give the ferric chlorid test for salicylic acid and the negative test for salicylic acid with Jorissen's reagent and with Millon's reagent.

Canned sea urchin, F. T. SHUTT (*Canada Expt. Farms Rpts. 1915, pp. 149, 150*).—Analyses were made of canned sea urchin prepared for food purposes. The composition of the material was as follows: Water, 66.64 per cent; albuminoids, 12.01 per cent; fat or oil, 12.88 per cent; and ash, 1.09 per cent.

1001 tests of foods, beverages, and toilet accessories, good and otherwise, H. W. WILEY and ANNE L. PIERCE (*New York: Hearst's International Library Co., 1916, rev. ed., pp. XXVIII+344, pl. 1*).—The earlier edition of this work has been noted (E. S. R., 32, p. 162).

[South Dakota food and drug law] (*Vermilion, S. Dak.: State, 1916, pp. 15*).—The text of the South Dakota law and the opinion of the Attorney General relative to it are given, together with rules and regulations issued under the law.

Report of the dairy and food commissioner for the year 1914, B. L. PURCELL (*Ann. Rpt. Dairy and Food Comr. Va.* [7] *(1914–15), pp. 64*).—The results are reported of the inspection of dairies, slaughterhouses, groceries, hotels, restaurants, etc., and data are given regarding 660 samples of food and feeding stuffs, of which 121 were found to be in violation of law.

Annual report of the dairy and food commissioner of Virginia, B. L. PURCELL (*Ann. Rpt. Dairy and Food Comr. Va.* [8] *(1915–16), pp. 20+50+63+55+63*).—This publication consists of four quarterly reports covering the period from March 1, 1915, to March 1, 1916. It reviews the work done by the dairy and food division of the state department of agriculture, which included the sanitary inspection of restaurants, lunch rooms, grocery stores, dairies, etc. Examinations and analyses of samples of food, feeding stuffs, etc., were made.

Storage, handling, and sale of food in Philadelphia, JANICE S. R. LIT (*Rpt. Henry Phipps Inst.* [*Univ. Penn.*], *12 (1916), pp. 9–55, pls. 10, figs. 11*).—This is a report of a study undertaken to obtain an idea of conditions existing in the city. During 1915 over 1,000 stores (including groceries, bakeries, meat shops, fish markets, creameries, ice-cream and confectionery stores, and produce establishments) and about 200 pushcarts and street stands were examined and scored on various factors, such as sanitary conditions of the surroundings, type and number of workers, protection of food against contamination, grade of food handled, storage of food, etc. The districts chosen were considered to be representative of various sections of the city.

Many of the places where food was sold were in poor repair, and in many instances toilets and washing facilities were not provided. Evidences of expectoration were prevalent in the main storerooms in about 40 per cent of the

places investigated. One of the worst conditions noted was the lack of screening or other means of protecting the food from domestic animals and flies and from handling by prospective buyers. Fruit, cakes, pies, bread, candy, and meats were very frequently exposed to such contamination. Conditions in municipal markets were found to be generally worse than in the stores, the sanitary condition of the sheds being bad and practically all of the foods exposed. As a result of the study, legislation and changes in the organization of the city health department were recommended. The publication contains several illustrations, maps, and tables, which present the results of the investigation.

Food inspection service in Philadelphia (*Rpt. Henry Phipps Inst.* [*Univ. Penn.*], *12* (*1916*), *pp. 57–94, figs. 13*).—This report describes and criticizes the food-inspection service of the city and recommends means for overcoming its limitations and objectionable features. It is based upon the study reported above.

A photographic method for measuring the surface area of the (human) body, F. G. Benedict (*Amer. Jour. Physiol.*, *41* (*1916*), *No. 3*, *pp. 275–291, figs. 5*).—A method is described which establishes a relationship between the area of the body as computed from photographic views of certain definite poses of the nude figure (particularly a side view with arm extended) and the area as actually determined by the linear formula of DuBois (E. S. R., 35, p. 370).

"Comparisons between the photographed areas and the body surface as computed from the DuBois linear formula show, even with the most diverse configurations of body, a constancy rarely observed in anatomical measurements or in computed ratios based upon such measurements."

The relationship between body surface and heat production especially during prolonged fasting, F. G. Benedict (*Amer. Jour. Physiol.*, *41* (*1916*), *No. 3*, *pp. 292–308*).—A historical review is given of the development of the idea of proportionality between the area of the body surface and heat production. Employing the photographic method described in the above article, the body area of the subject of a 31-day fasting experiment (E. S. R., 33, p. 566) and the heat production per square meter of body surface were recomputed.

"The values obtained showed a decrease similar to that previously found. The decrease in the heat production per sqaure meter of body surface amounted to 28 per cent, a decrease that can be interpreted only as proof of the inapplicability of the surface area law to subjects with widely varying states of nutrition. This shows it to be impossible to compare a standard value obtained with a large number of robust, normal individuals with that obtained with emaciated diabetics, and thus supplies strong proof of the legitimacy and practicability of the group system of comparing pathological cases with normal individuals of like height and weight, i. e., of general anatomical and morphological similarity."

The effects of exposure to cold upon experimental infection of the respiratory tract, J. A. Miller and W. C. Noble (*Jour. Expt. Med.*, *24* (*1916*), *No. 3*, *pp. 223–232*).—The experiments here reported are part of a series carried out by the New York State Ventilation Commission to determine the physiological effect of low temperatures. Laboratory animals (rabbits), after being subject to sudden changes of temperature from hot to cold and cold to hot, were inoculated by spraying the mucous membranes of the nose and throat with a live culture of *Bacillus bovisepticus*, an organism pathogenic to rabbits. The following conclusions are drawn from these experiments.

"Respiratory infection of rabbits with *B. bovisepticus* (snuffles) is favored by chilling the animals after they have been accustomed to heat.

"The character of this disease, which occurs frequently in rabbits under natural conditions, makes the application of the experimental results to similar

respiratory conditions in man less open to objection than in similar experiments with other infections.

"The weight of experimental evidence, including . . . [that of the authors], does not justify the elimination of exposure to cold as a possible though secondary factor in the incidence of acute respiratory disease.

"From the limited data of . . . [the] last two experiments it is suggested that any marked change of temperature predisposes rabbits to this infection, the severity of which varies with the amount of change, and that a change from low to high temperature has an even more marked effect than that from high to low."

ANIMAL PRODUCTION.

The relative value of field roots, F. T. Shutt (*Canada Expt. Farms Rpts. 1915, pp. 150–155*).—Analyses are given of 24 varieties of mangels, 30 varieties of turnips, and 8 varieties of carrots.

It appears that while the character of the season has much to do with the relative richness of mangels, heredity also plays an important part in this direction. There were many instances in which the turnips closely approached or equaled mangels in dry matter content, but they were decidedly inferior to mangels as regards sugar. Carrots were not markedly different from turnips in their percentage of dry matter, but were much richer in sugar.

Fodders and feeding stuffs, F. T. Shutt (*Canada Expt. Farms Rpts. 1915, pp. 127–149*).—Analyses are given of the following feeding stuffs: Oats, barley, bran, shorts, ground corn, gluten feed, oil-cake meal, flax meal, soy-bean cake, cotton-seed meal, peanut-oil meal, rice meal, rice polishings, tankage, fish scrap, alfalfa meal, molasses, feed flour, Kafir corn, screenings, potato cake, corn and clover silage, frozen shredded corn, oat fodder and oat silage, prairie hay, timothy hay, and oat straw, and various mixed and proprietary feeds.

Beef cattle, E. S. Archibald et al. (*Canada Expt. Farms Rpts. 1915, pp. 361–392, pls. 4*).—Results of experiments with three lots of 4 steers each, lot 1 being grades showing a little beef blood, lot 2 medium butcher cattle, and lot 3 dairy steers, show that the ordinary steer of the country can be fed at a good profit if the feeding period is not more than five months.

Four lots of 6 Shorthorn steers each, lots 1 and 3 being classed as good butchers and lots 2 and 4 as good stockers, were fed, lots 1 and 2 receiving 50 per cent more roots and meal than lots 3 and 4, while half of lots 1, 2, 3, and 4 received in addition to their regular ration 2 lbs. of molasses per steer per day. The heavy-fed lots of stockers showed a greater increase in weight than the light-fed lots, but this was not true of the butchers. The greatest profits, therefore, were realized from the heavy-fed stockers and light-fed good butchers. In every case except one where molasses was added to the meal ration there was a decided increase in the total gain, but the increase was hardly sufficient to compensate for the high cost of molasses.

Three lots of 8 steers each, one rated as of the best type and kept loose, one of medium type and kept loose, and one of medium type and kept tied, made average daily gains for 121 days of 2.41, 1.83, and 1.64 lbs., respectively, at a cost per pound of gain of 8.34, 10.98, and 12.23 cts. Two uniform lots of 4 steers were fed for 121 days, one lot receiving an addition of 0.93 lb. molasses daily during the last 59 days. This lot made an average daily gain per head of 1.7 lbs. at a cost per pound of gain of 12.05 cts., as compared with 1.59 lbs. and 12.4 cts. for the check lot.

Three lots of steers, lot 1 being choice; lot 2, fair; and lot 3, dairy-type of steers, fed 135 days, made average daily gains per head of 1.69, 1.59, and 1.22

lbs., consuming per pound of gain 14.94, 15.81, and 20.65 lbs. of dry matter, and costing per pound of gain 14, 15, and 19 cts. for the respective lots.

Two lots of 19 and 12 steers, one fed tied and the other loose, made average daily gains per head of 1.4 and 1.6 lbs., consuming per pound of gain 17.71 and 15.43 lbs. of dry matter, and costing per pound of gain 16 and 14 cts., for the respective lots.

Two lots of 6 steers each, fed 143 days, lot 1 fed loose, and lot 2 tied, made average daily gains per steer of 2.01 and 1.46 lbs., realizing a profit per steer of $11.20 and $5.60 for the respective lots.

Two lots of steers fed 124 days, lot 1 on a light silage and a heavy grain ration, and lot 2 on a heavy silage and a light grain ration, made average daily gains per head of 1.193 and 1.371 lbs., and average profits per steer of 78 cts. and $7.21, for the respective lots.

Two lots of steers fed 181 days, lot 1 on corn fodder and lot 2 on corn silage, in addition to the grain ration, made average daily gains per steer of 1.44 and 1.88 lbs., costing per pound of gain 10.02 and 7.7 cts., and realizing a profit per steer of $1.13 and $6.76, for the respective lots.

Six groups of steers of two lots each, two and three years old, respectively, were fed 160 days at Indian Head, Sask., as follows: Group 1, oat straw, prairie hay, and a meal composed of equal parts of barley and oats; groups 2 and 3, the same ration as group 1; group 4, oat straw, oat sheaves, and the same meal as group 1; group 5, oat straw, prairie hay, silage, and same meal ration as group 1; group 6, oat straw, prairie hay, silage, and a meal composed of barley, oats, peas, bran, and oil cake when finishing. Group 1 was fed outside, loose; group 2, inside, loose; groups 3, 4, 5, and 6, inside, tied. The steers fed loose gave far better returns than those tied. Steers fed outside gave larger profits than those similarly fed inside, tied, while those fed the same as the former two groups, but inside and loose, gave the best results of all. The results with those fed oat sheaves show little in favor of this ration, there being always a certain amount of waste, together with a lack of uniformity of quality in the feed.

Four lots of steers were fed as follows, in addition to the basal grain ration: Lot 1, alfalfa; lot 2, alfalfa and oat sheaves; lot 3, oat sheaves; lot 4, alfalfa and corn fodder. These steers made average daily gains per steer of 0.83, 0.96, 0.81, and 1.47 lbs., costing per pound of gain 23, 20, 19, and 11 cts., and realizing a net profit per steer of 38 cts., $3.96, $6.61, and $3.15, for the respective lots.

Data are given on the cost of pasturing yearling steers at Lacombe, Alberta. These steers made average daily gains for a period of five months, on pasture, of 0.88 lb., at a cost per pound of gain of 3.72 cts.

Six lots of steers were fed during the winter 97 days at Lacombe as follows: Lot 1, green feed, inside; lot 2, timothy hay, inside; lot 3, silage and straw, inside; lot 4, prairie hay, outside; lot 5, in a corral, inside; lot 6, in the bush, outside. All lots received the ordinary grain ration. These steers made average daily gains per head of 1.51, 0.97, 1.055, 0.99, 2.14, and 1.52 lbs., at a cost per pound of gain of 8.75, 17.25, 12.98, 12.12, 5.93, and 9 cts., returning a profit per head of $3.45, −$2.50, 67 cts., $1.01, $7.90, and $3.03, for the respective lots.

Sheep, E. S. Archibald et al. (*Canada Expt. Farms Rpts. 1915, pp. 496–523, pls. 4*).—Six lots of lambs were fed 70 days as follows: Lot 1, a grain ration composed of oats, bran, and oil cake, 2 : 2 : 1; lot 2, 1 part of the above mixed with 1 part of elevator screenings; lot 3, complete ground elevator screenings; lot 4, complete ground elevator screenings, less blackseed; lot 5, ground blackseed; and lot 6, ground blackseed, 2 parts, and a molasses meal, 2 parts. These lots made average daily gains per head of 0.28, 0.31, 0.2, 0.29, 0.24 and 0.18 lbs., at a cost per pound of gain of 8.8, 6.2, 7, 5.4, 4.8, and 10.8 cts., with a net profit per animal of

54 cts., $1.16, 80 cts., $1.20, $1.33, and 31 cts., for the respective lots. Lot 4, fed the pulverized screenings with blackseed removed, after the first two weeks apparently consumed the meal with relish. Lot 5, on pulverized blackseed, refused the ration almost entirely for five weeks, and at the conclusion of the experiment were consuming about half the quantity fed. Lot 6, on equal portions of pulverized blackseed and molasses meal, consumed the ration cleanly from the start. No toxic effect was noticed from the use of the by-product in any of its grades. These lambs when finished for market, all lambs receiving the same meal mixture, composed of oats, bran, and oil cakes, 2 : 2 : 1, made average daily gains per head for 55 days of 0.28, 0.19, 0.33, 0.33, 0.43, and 0.36 lbs., at a cost per pound of gain of 9.4, 13.5, 7.7, 8.6, 6, and 7.1 cts. Lots 5, 6, and 3, receiving blackseed in various proportions, were all losing weight at the end of the regular experiment, having apparently reached their limit of production on a roughage diet supplemented by inferior meal. The results of this finishing period indicate that the blackseed-fed lambs were held back during the experiment, as evidenced by their very rapid comparative gains during the finishing period.

Five lots of 11 lambs each were fed 135 days as follows: Lot 1, clover hay; lot 2, mixed clover and timothy hay and corn stover; lot 3, timothy hay and mangels; lot 4, clover hay and roots; lot 5, clover hay and oil cake. They made average daily gains per head of 0.085, 0.071, 0.084, 0.132, and 0.149 lb., at a cost per pound of gain of 18, 20, 18, 12, and 11.9 cts., for the respective lots.

The average results of three years' tests of clover hay, mixed hay and corn stover, and timothy hay and roots as roughage for fattening lambs, show the average daily gains per head for 3 lots of 42 lambs each to have been 0.107, 0.058, and 0.063 lbs., for 103 days, at a cost per pound of gain of 15.5, 24.7, and 20.4 cts., respectively.

Four lots of lambs were fed 108 days as follows: Lot 1, timothy hay and meal; lot 2, timothy hay, roots, and meal; lot 3, a mixture of timothy hay and broadleaf hay and meal; lot 4, a mixture of timothy and broadleaf hay and roots and meal. They made average daily gains per head of 0.215, 0.29, 0.209, and 0.274 lbs., at a cost per pound of gain of 11.1, 10.32, 12.39, and 11.68 cts., for the respective lots.

Three lots of breeding ewes were wintered as follows: Lot 1 in an open shed, fed alfalfa; lot 2 in a sheep barn, fed alfalfa; lot 3 in a sheep barn, fed mixed hay. They made gains per head of 5.6, 5.1, and 0 lb., while the lambs made a gain per head of 5.8, 0, and —6 lbs., for the respective lots.

Three groups of lambs of two lots each, bought at Lethbridge, Alta., one lot fed barley straw, prairie hay, and a grain mixture of oats and barley, 1 : 1, and the other lot fed barley straw, prairie hay, and wheat screenings, one group being fed in a closed shed, one group in an open shed, and the third group in the open, made average daily gains per head for 112 days of 0.13 and 0.13 lb. in the two lots of the first group, 0.2 and 0.9 lb. in the two lots of the second group, and 0.19 and 0.19 lb. in the two lots of the third group, at a cost per pound of gain of 11 and 11 cts., 7 and 8 cts., and 8 and 8 cts. for the respective groups.

In a corresponding test with lambs bought at Indian Head, Sask., the average daily gains per heau were 0.12 and 0.12 lb. for the lots fed in the closed shed, 0.2 and 0.2 lb. for those fed in the open shed, and 0.15 and 0.16 lb. for those fed in the open, at costs of 12 and 12 cts., 7 and 7 cts., and 10 and 9 cts. for the respective groups.

A test in fattening a single pure-bred Shropshire wether indicated that the feeding of home-bred lambs may be profitable in Saskatchewan, while there is little or no profit in buying lambs.

Two lots of 240 lambs each were fed for 80 days, one lot receiving alfalfa and the other lot alfalfa and oat sheaves 2:1. The average daily gains per head were 0.021 and 0.024 lb. respectively, at a cost of 8.07 and 6.74 cts, per pound of gain.

Swine, E. S. ARCHIBALD ET AL. (*Canada Expt. Farms Rpts. 1915, pp. 524–573, pls. 4*).—Three lots of shotes were fed 70 days, as follows: Lot 1, shorts, oats, and corn, 1:1:1, and skim milk, fed as slop; lot 2, shorts, oats, corn, and skim milk fed as slop, plus green rape; and lot 3, shorts, oats, and skim milk, plus ground corn. The pigs made average daily gains per head of 1.5, 0.995, and 1.13 lbs., at a cost per pound of gain of 5.5, 6.2, and 5.9 cts., for the respective lots.

Five lots of pigs were fed 84 days, all lots receiving skim milk; lot 1, corn, shorts, and oil meal, 3:3:1; lot 2, corn, shorts, and tankage, 3:3:1; lot 3, corn and tankage, 6:1; and lot 4, corn and tankage, 6:1; and lot 5, corn. These pigs made average daily gains per head of 0.9, 0.9, 0.95, 0.43, and 0.76 lb., at a cost per pound of gain of 3.06, 4.3, 3.5, 4.23, and 3.1 cts., for the respective lots.

Six lots of pigs were fed 42 days as follows: Lot 1, corn, shorts, and oil meal 1:1:1, and milk; lot 2, the same grain ration, blackseed, and milk; lot 3, blackseed and milk; lot 4, buckwheat screenings and milk; lot 5, complete screenings, flour, and milk; and lot 6, blackseed and water. These pigs made average daily gains per head of 1.05, 0.76, 0.14, 0.9, 0.48 and 0.01 lbs., at a cost per pound of gain of 4.7, 3.8, 7.6, 2.7, 4 and 36 cts., for the respective lots. "To summarize the value of blackseed in this experiment it is safe to say that the food value of this by-product is low even when fed in small quantities in a well-balanced ration containing good variety; that it has little food value when fed alone or in conjunction with only one or two other feeding stuffs; that animals of 160 lbs. weight can be made to eat 2 lbs. each per day and thus maintain weight for a short period of about a month and a half; that this product is rather unpalatable and, if constituting any considerable proportion of the grain ration, is unpleasant to the animals.

These lots were finished, all receiving for 42 days the same grain mixture, with the following results: An average daily gain per head of 0.57, 0.88, 0.88, 0.83, 0.64, and 1.26 lbs., at a cost per pound of gain of 7.3, 5.7, 4.7, 5.6, 4.7, and 4.69 cts., for the respective lots.

Three lots of sows were fed as follows: Lot 1, a regular grain mixture composed of bran, shorts, and cracked corn, 1:1:1, fed as a thick slop; lot 2, the same meal mixture except that one-fifth by weight of this mixture was replaced by tankage; and lot 3, whole corn in a hopper grinder, together with shorts and bran. In addition to the above grain ration all the sows received roots, clover or alfalfa hay, and skim milk. The amount and cost of feed per sow per day did not vary to any extent within the three lots except where tankage entered into the ration, in which case the cost was higher, the increase being proportionate to the amount of tankage used. The gain in weight of the sows before farrowing and loss during the eight weeks immediately after farrowing were fairly constant, with the smallest loss after farrowing in favor of the tankage ration. The condition of the young pigs at birth was in favor of the tankage ration. The average weight of pigs at birth was practically equal in all lots, while the weights at four weeks and eight weeks of age showed a slight increase in gain in each case in favor of the tankage ration. A comparison of lot 1, the check lot, with lot 3, where the grinder was used, showed only a slight advantage in weight in the litters at all stages of growth.

Four lots of 5 pigs each were fed 107 days as follows: Lot 1, barley chop; lot 2, barley chop and feed flour, 3:1; lot 3, barley chop and shorts, 3:1; and

lot 4, barley chop and oat chop, 1:1. These pigs made average daily gains per head of 1.37, 1.48, 1.32, and 1.24 lbs., at a cost per pound of gain of 4.79, 4.61, 4.87, and 5.63 cts., for the respective lots. It appears that barley chop is a good feed for fattening hogs, as all the hogs in the experiment made good gains. Oat chop and barley chop gave the poorest gains and the costliest gains. Oat chop is not deemed as good a feed for fattening hogs as the other combinations under test and at present prices costs too much. The addition of feed flour to the barley chop, even though it made a more expensive feed, increased the gains in weight and made the cost of production lower. Shorts did not give as good results as feed flour for mixing with barley; in fact, the barley alone in this test did slightly better than barley and shorts.

Three lots of weanling pigs were fed as follows: Lot 1, barley and skim milk; lot 2, shorts and water; lot 3, shorts and skim milk. These pigs made average daily gains of 0.52, 0.67, and 1 lb., at a cost per pound of gain of 5.92, 4.76, and 3.12 cts., for the respective lots.

Two lots of pigs were fed as follows: Lot 1, frosted wheat and water; and lot 2, oats, barley, and skim milk. These pigs made average daily gains of 1.37 and 1 lb., at a cost per pound of gain of 3.26 and 6.51 cts., respectively. In a second test, a lot of 5 hogs fed well-ground frozen wheat and water made an average daily gain per head of 1.83 lbs., and a similar group fed well-ground oats and barley 1.62 lbs. The respective costs per pound of gain were 4.12 and 4.82 cts.

It is estimated that the cost of feed per pig raised from the time of farrowing to weaning is \$2.32; the cost of raising young sows from weaning to six months of age, \$7.12; and the cost of raising young sows from six months to one year of age, \$9.49.

Continuing previous work (E. S. R., 33, p. 761), experiments in feeding phosphorus in various forms to pigs show a distinct benefit in feeding inorganic phosphorus with rice meal. In all, 129 pigs were put through the trials. Forty-nine of these were fed rice meal in various proportions with other grains and all developed the typical diseased condition previously noticed in rice-meal-fed pigs. Phosphorus in different forms was given as a complementary food to the above ration with 48 hogs. With one exception these hogs remained perfectly healthy throughout the trials and showed no ill effects from the rice meal. Calcium phosphate in smaller quantities fed to 4 pigs failed to counteract completely the injurious effects of a ration of rice meal. Liberal quantities of muriate of potash were absolutely ineffective in the case of pigs fed on a ration containing rice meal. Twenty-four control pigs fed on rations not containing rice meal remained normal and healthy throughout.

It is concluded that the injurious effects of rice meal in proportions as low as one-third of the total grain ration have received further confirmation. "Inorganic phosphorus added to the ration containing rice meal is capable of counteracting these injurious effects. From the work done, ground phosphate rock appeared to give better results than the other forms used. More work is necessary in this connection."

Horses, E. S. ARCHIBALD ET AL. (*Canada Expt. Farms Rpts. 1915, pp. 474–495, pls. 6*).—Data are given on the cost of wintering idle horses. It was found during four years' observations that horses weighing around 1,250 lbs. can be fed, idle, for a little less than 10 cts. per day upon a pound each of rough hay, oat straw, and carrots or swedes to 100 lbs. live weight. The average total cost of feed for the period of 151 days was \$14.33 per head.

Experiments in wintering colts outside under single-boarded sheds when the temperature went down to as low as 31° F. below zero indicate that this prac-

tice may be successfully carried on. It takes a little more feed to keep up the necessary warmth, but against this extra cost may be placed the greater constitution of the horses.

Four lots of horses were fed as follows: Lot 1, oat straw, oat sheaves, oats, and bran; lot 2, oat straw, mixed hay, oats, and ground flaxseed; lot 3, oat straw, mixed hay, oats, and bran; lot 4, oat straw, alfalfa hay, oats, and bran. The most expensive ration was that in which flaxseed was fed, while that containing alfalfa hay followed next. The ration composed of mixed hay, oat straw, oats, and bran was the cheapest.

Two lots of idle work horses, one wintered on pasture during the day and stabled at night and the other kept in the stable, were kept at a total cost per horse per day of 13.5 and 12.8 cts.

It is estimated that the cost per day for feeding a colt rising one year old is 10.6 cts.; that of a colt rising two years old, 9.33 cts.; and that of a colt rising three years old, 6.08 cts.; or a total cost up to three years old of $71.96. The average cost of carrying three fillies, one year old, during the summer was 6.95 cts. per pound of gain, the fillies making an average daily gain of 1.24 lbs.

The economy of mule production in the South and methods of management, H. K. GAYLE and E. R. LLOYD (*Mississippi Sta. Bul. 176 (1916), pp. 3–15, figs. 4*).—Data are given on the average cost of raising mules at the station of the three types: (*a*) The lighter type of "cotton mule," standing 14.5 hands high and weighing 800 lbs.; (*b*) the typical cotton mule, weighing 1,100 lbs. and standing about 15.5 hands high; and (*c*) the 16-hand 1,250-lb. farm work mule.

It is found that charging interest on all money invested at 8 per cent and 10 per cent depreciation in the value of the brood mare yearly, and valuing all feeds used at their average market value, mules are still produced at a good profit; the small mule at a profit of $28.62 per head, the cotton mule at a profit of $35.38 per head, and the heavy work mule at a profit of $55.48 per head. "The farmer who can give the brood mare enough work to pay for her keep and depreciation can raise mules in the South for less than one-half their cost on the open market."

"Where the cost of keeping the mare must be included but no account taken of the interest on the money invested or her depreciation in value the small-type mule can be produced in the South for two-thirds his market value, the cotton mule for slightly over one-half his market value, and the better-grade farm mule for less than one-half his market value."

Report from the poultry division for the year ended March 31, 1915, F. C. ELFORD ET AL. (*Canada Expt. Farms Rpts. 1915, pp. 1101–1118, 1120–1152, pls. 12, figs. 2*).—Experiments to determine the effect of the shipping of hatching eggs show on the average a decrease of about 20 per cent in fertility and 23 per cent in hatchability in the shipped eggs. In comparative trials in marketing late pullets in the fall and in holding over until spring it was found that the latter method paid. It is estimated that the table scraps fed for four months from a family of three persons were worth in new-laid eggs $6.59.

In experiments to test the possibility of using whey instead of skim milk in mixing the mash for crate-feeding poultry, three lots were fed as follows: Lot 1, skim milk; lot 2, whey; and lot 3, whey and beef scrap. The 11 birds in lot 1 and 12 birds in lots 2 and 3 made, during the three weeks' period, gains of 27.5, 13.5, and 10.5 lbs., costing per pound of gain 6.8, 12, and 16 cts., for the respective lots.

Two lots of 12 cockerels and capons each, fed three weeks during the fall, made total gains of 27.5 and 18 lbs., costing per pound of gain 6.9 and 10 cts., and bringing a total profit of $13.41 and $17.20, for the respective lots. A

second lots of 12 capons, fed until spring, made a total gain of 8 lbs. at a cost of 25 cts. per pound of gain, and bringing a profit of $19.42. The fall cockerels sold for 20 cts. per pound and the fall capons for 25 cts., while the capons in the spring brought 35 cts.; but the capons sold in the spring had cost $7.98 for feed to carry them over the winter. The capons grew in weight better than the cockerels before going into the crates, but did not do so well during the three weeks crate feeding, and the cost in the crates was more per pound. The higher sum received for the fall capons was just equivalent to what the 5 cts. higher price amounted to. The advisability of keeping capons until spring depends upon the amount of the greater price received for them.

Tests to determine the fertility of eggs after removal of the male indicate that there are traces of fertility even to the eighteenth day after removal.

Two lots of 12 hens each were fed 21 days as follows: Lot 1, a grain mixture made up of ground oats, corn meal, middlings, and beef scrap, 2:2:2:1, and moistened with water for feeding; and lot 2, ground oats moistened with skim milk. Both lots were fed 1 lb. three times per day for the first week, and 2 lbs. twice a day for the following two weeks. Water was given twice a day. These hens made average gains of 14.48 and 16.1 oz., and the food cost was 13.58 and 14.75 cts., per hen for the period.

Temperature records were kept of colony houses at Brandon, Manitoba, constructed as follows: Numbers 1 and 3, tar paper and one ply of boards with an extra ply of boards on the back; number 2, double boarded outside of studs all over; number 4, tar paper and one ply of boards; number 5, one ply of boards on the outside of studs and one ply on the inside of studs; and number 6, tar paper and one ply of boards on the outside of studs and boarded up on the inside of studs just around the roosts. Number 6 was always the coldest, but it had fewer hens and was the most exposed. Number 4 was the next coldest, but it had also few hens and was just enough warmer to allow for its extra shelter. Number 1 was the third coldest. It was well sheltered by bush and had plenty of birds, but was somewhat damp inside and some of the birds had their feet frozen. Number 2 gave much the same results as number 1, except that it was drier and did not have quite so much variation in temperature. Number 5 gave the best results of all. It was no warmer than number 3, but it had a much more uniform temperature than any of the other houses and was a great deal drier. Although number 3 was the same in construction as number 1, it was much warmer and drier. This may be explained by the fact that it had the greatest number of birds and was the center of the row.

The temperatures were also take on the roosts with the curtains down around the roosts, and the difference between the temperature of the house outside the curtain and that of the roost noted. In every case the roost was warmer than the rest of the house, varying from a few degrees up to as high as 20° F. These results show that it is preferable to have a curtain to drop in front of the roost on really cold nights, as it adds considerably to the comfort of the birds. No influence on egg production can be traced to the effect of the houses, as differences in strain and age of the birds were more effective factors in determining the number of eggs laid.

Beginning on November 1, records of the eggs laid by the pullets and hens of each breed were kept. The Wyandotte pullets commenced to lay on November 13 and the Plymouth Rock pullets on November 19. From this time on during the entire winter the pullets gradually increased their egg production and the hens fell off in theirs till about the end of January. This shows that the pullet is essentially the winter egg producer. The White Wyandottes were

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much superior to the Barred Rocks as winter layers, although about February 15 the Rock pullets began to lay better.

Temperature records were kept of colony houses at Indian Head, Sask., constructed as follows: Number 1, building paper and one ply lumber (two ply around the roost space), one sash glass, two cotton frames, board floor, and shingle roof; number 2, two ply lumber, tar paper between, all-cotton front, earth floor, shingle roof; number 3, two ply lumber, tar paper between, cotton front and also glass 14 in. wide full length of front, earth floor, shingle roof; and number 4, two-ply lumber, tar paper between, roost space sealed inside with beaver board, board floor, ruberoid roofing, all-cotton front. The winter was extremely mild, and no striking differences between the houses or the egg production was noted.

Records were kept of the temperatures in a large frame house at Lacombe, Alta., which accommodated about 100 birds, and in a straw house which has a floor space for about 80 birds. During the latter half of January, through February and the latter half of March, while the temperature was higher in the frame house, the birds in the straw house did not suffer.

The percentages of hatchability of eggs produced in the long, square log, and straw types of houses were 38.6, 56.9, 52.7, and 31, respectively.

Comparing the cost of 1,200- and 140-egg capacity incubators it was found that the former could be operated at a cost of 35 cts. and the latter at $2.09, per 100 chicks hatched, the percentage hatched being 46.1 and 41.4, respectively.

The following table shows a comparison between the performances of early-hatched and late-hatched pullets:

Early v. late hatched pullets.

Breed.	Hatch.	No. of birds in pen.	Period.	Eggs laid.	Weight of eggs per dozen.	Cost of eggs per dozen.	Fertile eggs.	Total eggs hatched.
			Days.		*Oz.*	*Cts.*	*P. ct.*	*P. ct.*
White Leghorns	Early	49	170	1,618	25.20	21.50	85.8	49.0
Do	Late	53	151	1,054	23.50	34.90		
Barred Plymouth Rocks	Early	46	170	2,242	23.48	23.98	80.3	32.3
Do	Late	45	149	1,617	23.54	25.62		

From an egg-producing point of view, with White Leghorns, it would appear that it is better to hatch them early and let them get their full growth on the range before putting them into laying pens. In the case of the Barred Rocks also the early-hatched pullets gave the more profitable returns, but there was not so much difference with this breed as with the Leghorns.

Early-hatched White Leghorns were compared as to performance with their mothers, two years old. The results indicate that pullets only should be relied on for winter egg production. The strong, healthy pullets in this instance gave better fertility and hatchability than did their mothers.

Comparing selected and unselected pullets, the results indicate that it pays to cull a flock and to keep only those of known egg-laying strain. Comparing 5 *v.* 32 females to 1 cockerel, the former method resulted in a higher fertility and hatchability of eggs.

Comparative costs of operating four incubators are given. The average cost for all machines was 2.88 cts. per chick. The total cost of raising chicks to five weeks of age under a stove heater was estimated to be 14.2 cts. per chick.

In trials to determine the effects of certain well-known feeds when fed exclusively, pen 1 was fed wheat flour, best grade, baked in cakes. After 31

days the birds all became weak in the legs, ate sparingly, and gradually became comatose. They were all dead on the forty-sixth day. Pen 2 was fed wheat flour, best grade, baked, and inorganic phosphorus. The eggs were small and yolks white. Two birds died with the same symptoms as those in pen 1. Another bird recovered and laid eggs, but showed leg weakness. Pen 3 was fed ground wheat, baked in cakes. The eggs were normal, and, aside from one weakling, the birds remained healthy throughout the trial. Pen 4 was fed rice meal, baked in cakes. The eggs were small, the yolk almost white. One of the birds was attacked and eaten by her mates, having become too weak to defend herself. Her bones were very pliable. The others improved after eating their mate. Pen 5 was fed rice meal, baked, and inorganic phosphorus. The eggs were small, the yolks very pale, but the birds stayed in good condition throughout the trial. Pen 6 was fed polished rice, boiled. The eggs were normal. The birds showed alternate periods of normal feeding and sickness. When feeding normally the droppings were very watery. Pen 7 was fed unpolished rice, boiled. The birds kept in good condition throughout, but the droppings were very watery. Pen 8 was fed cracked yellow corn, boiled. The eggs were very small but normal in color. The birds kept in fair condition, but the droppings were watery. Pen 9 was fed yellow corn meal, baked. The eggs were normal in size and color. One bird showed weakness in legs and trembling after 41 days, but twice made a temporary recovery. Pen 10 was fed corn meal, baked, and phosphorus. The eggs were normal and the birds kept in good condition throughout the trial. Pen 11 was fed a starvation allowance of corn, wheat, barley, oats, and peas. The eggs were normal and the birds were very hungry but were the most healthy and active of all the birds. Pen 12 received a normal quantity of corn, wheat, barley, oats, and peas. The eggs were normal and the birds kept in good condition all through the trial. The inorganic phosphorus used in the above trials consisted of equal portions, by weight, of ground phosphate rock and basic slag. This was supplied in very small quantities, but helped to keep the birds in better condition when fed on rations normally low in this element. Even in a ration of corn meal, which is not so deficient in phosphorus as some other feeds, there was a marked difference in the condition of the birds. Boiled rice and boiled corn seemed to have about the same laxative effect on the birds.

A large number of eggs were measured and weighed in order to find out what effect the extreme dimensions had upon the weight. It was found that an increase in length or width above the normal was not always accompanied by an increase in weight. It appears that the degree of tapering either at one or both ends has a greater influence on the comparative weight than either of the extreme dimensions.

From records kept it is estimated that it costs 21.9 cts. to hatch and rear one duckling to three weeks of age.

Studies on the physiology of reproduction in the domestic fowl.—XV. Dwarf eggs, R. Pearl and Maynie R. Curtis (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 25, pp. 977–1042, pls. 2, figs. 4*).—This paper discusses (1) the different types of dwarf eggs in respect to shape and also in respect to contents; (2) the variability in respect to size and shape; (3) the interrelations of the variations in dimensions, shape, and size; (4) the frequency of the occurrence of dwarf eggs compared to normal eggs and of dwarf-egg producers compared to birds which do not lay dwarf eggs; (5) seasonal distribution of dwarf eggs; (6) dwarf-egg production by birds with normal and with abnormal oviducts; (7) the relation of dwarf-egg production by normal birds to the age of the bird and to the position of the egg in the clutch and litter; (8) physiological conditions which lead to dwarf-egg production; (9) the relation of the

production of dwarf eggs to other abnormal phenomena of reproduction which either occur in nature or have been experimentally produced; and (10) the contribution which the study of the physiology of dwarf-egg production makes to our knowledge of the normal physiology of egg production. The investigations were made at the Maine Station from February, 1908, to February, 1916, during which time 298 dwarf eggs were known to have been produced at the poultry plant of the station.

During the two years of maximum dwarf-egg production the ratio of dwarf eggs to normal eggs was 1:1,158. It was found that there were two distinct types of dwarf eggs in respect to their shape, the prolate-spheroidal type similar to the normal egg and the cylindrical type which is much longer in proportion to the breadth. Only 4.6 per cent of the eggs examined were of the cylindrical type. About two-thirds of the dwarf eggs examined contained yolk, which in the large majority of cases was not inclosed in a yolk membrane. A comparison of the mean egg size of the several groups of dwarf eggs confirmed the evidence obtained from a study of normal and multiple-yolked eggs (E. S. R., 31, p. 570) that the amount of yolk (or other nucleus) present in the oviduct is an important factor in determining the amount of albumin secreted in a given case. The correlations between yolk weight and egg weight and between yolk weight and albumin weight in dwarf eggs with small yolks were very high. Of the dwarf eggs collected during this investigation 70.8 per cent were laid during the five months from March 1 to July 31. The dwarf-egg production was also highest in proportion to the normal-egg production during the spring and early summer.

It was found that the production of a dwarf egg is usually an isolated phenomenon; that is, a bird usually produces only one such egg. The 251 dwarf eggs of known origin in these studies were laid by 200 birds. Of these 200 birds 178 produced 1 dwarf egg each, 15 produced 2 dwarf eggs each, 3 produced 3 dwarf eggs each, and 4 produced 4, 5, 8, and 17 dwarf eggs each, respectively. Most of these birds had a normal egg record, and the dwarf egg was preceded and followed by normal eggs.

A study of all the egg records and the available autopsy records for birds which produced one or more dwarf eggs showed that in most cases the disturbance which caused the production of the dwarf eggs was of temporary character and was not correlated with a morphological disturbance of the sex organs. The records of only 11 of the 200 birds showed evidence of a permanent disturbance of the egg-forming processes, and these 11 included all the cases where the bird produced more than three dwarf eggs, two that produced three, one that produced two, and four that produced only one dwarf egg. In these 11 cases few or no normal eggs were produced after the dwarf egg or eggs, although nesting records indicate that the ovary passed through normal reproductive cycles. Autopsies were made on five of these cases, and all of them showed some pathological condition of the oviduct which interfered with the passage of the egg, but did not entirely close the duct. Dwarf-egg production was found not to be associated with immaturity.

Data on the position of the dwarf egg in the clutch and litter show that the dwarf eggs may be produced at any time during the laying period. Of 183 dwarf eggs produced by normal birds which completed the period of production during which the dwarf egg was laid, 8 were first and 11 were last eggs in their respective litters. "A dwarf egg may be overtaken by a normal egg and form one of the components of a compound egg similar to a double-yolked egg, except that one part is a dwarf egg. A dwarf egg, after it has received its membrane or its membrane and shell, may be returned up the duct and be included in the succeeding normal egg, or it may act as the stimulus for the

formation of a larger inclosing dwarf egg. Dwarf eggs are produced only when the ovary is in the absolutely active condition associated with the maturing of yolks. This is true whether the bird has a normal or pathological oviduct. When the sex organs are in this condition, a mechanical stimulation of the oviduct by an artificial yolk may result in the formation of a complete set of egg envelopes."

The Shoup oat sprouter, Mr. and Mrs. G. R. Shoup (*Washington Sta., West. Wash. Sta. Mo. Bul., 4 (1916), No. 6, pp. 12–20, fig. 1*).—In addition to notes on feeding sprouted oats and on oat sprouting devices for small flocks, directions are given for the construction and operation of an oat sprouter suitable for large flocks of laying hens.

DAIRY FARMING—DAIRYING.

Dairy cattle, E. S. Archibald et al. (*Canada Expt. Farms Rpts. 1915, pp. 393–418, 426–473, pls. 8*).—From experiments in feeding elevator screenings to dairy cattle it appears that this material has a fair feeding value. The attitude of the individual cows to the screenings meal rations differed widely. Some showed little preference one for the other; others ate only portions for a few days; others refused it altogether, carefully cleaning up all the roughage with which the meal was fed and leaving practically all of the meal in the manger; others, again, refused throughout the entire period all feed containing screenings. With the exception, however, of certain animals that consistently refused the meal ration, the herd during the second week of the period, as a rule, consumed it cleanly. It would appear from these short tests that the value of screenings lies not in any palatability that it may add to a ration, and not conclusively in its power to produce, but rather in its cheapness.

In experiments comparing turnips and molasses for dairy cattle it was found that while the amount of roughage necessary to produce a pound of fat or milk is much lower where molasses is fed, the cost to produce, as figured on the values given, is increased when compared with the average results of the root-feeding periods, while the actual production of milk during the molasses-feeding period is slightly lower. In this experiment 254 lbs. of molasses, 5 lbs. of meal, and 6 lbs. of hay were equivalent to 1,890 lbs. of roots. It is concluded that while molasses may replace a part of the succulent ration, it can not wholly replace roots either from the standpoint of increased production or lessened cost.

In an experiment comparing corn silage and molasses for dairy cattle it was found that 252 lbs. of molasses was equivalent to 31 lbs. of meal, 20 lbs. of hay, and 1,039 lbs. of silage. It appeared that the replacing of 15 lbs. of silage with 4 lbs. of molasses resulted in an increase in milk production sufficient to offset the greater cost of the ration.

Five lots of calves were fed with the following results: Lot 1, fed on whole milk, clover hay, and roots, made good gains at a cost of 14.15 cts. per pound of gain; lot 2, fed on a home-mixed calf meal composed of ground oats, ground corn, and ground flax, 2 : 4 : 1, plus skim milk, clover hay, and roots, made gains costing 3.04 cts. per pound; lot 3, fed a commercial calf meal as a water slop, plus clover hay and roots, but with no skim milk, made satisfactory gains at a cost of 2.36 cts. per pound; lot 4, fed the same calf meal, skim milk, clover hay, and roots, made very satisfactory gains at a cost of 4.48 cts. per pound; and lot 5, fed another commercial meal, skim milk, clover hay, and roots, made very satisfactory gains at a cost of 3.01 cts. per pound.

Experiments with the milking machine showed that the cows did not materially decrease in their milk flow. The quantity of strippings produced after

the milking machine was quite variable, averaging from 0.125 to 1 lb. per cow per milking. The hand-produced milk contained, as a rule, less than one-third the bacterial content of the machine-produced milk. No ill effects whatever on the cows' teats resulted from the use of the milking machine.

Data are given on the cost of second-class Ayrshire heifers and first-class Guernsey heifers from birth to one year of age, also of Holstein heifers from the time they were yearlings until they dropped their first calf.

Four lots of calves were fed daily per head as follows: Lot 1, from 6 to 20 lbs. of whole milk, as needed; lot 2, from 10 to 20 lbs. of skim milk and a meal ration of oats, corn, and flax (all ground), 2:4:1; lot 3, a calf meal and water; lot 4, from 10 to 20 lbs. of skim milk and the calf meal. All the lots received hay and silage as required. They made average daily gains per calf of 1.91, 1.61, 0.87, and 1.6 lbs., at a cost per pound of gain of 9.32, 2.84, 12.33, and 5.42 cts., consuming per pound of gain 1.47, 1.47, 2.97, and 1.78 lbs. digestible matter for the respective lots.

Experiments were conducted to determine the best quantities of grain to be fed. All of the cows received the same quantity of roughage, hay, silage, and swedes. Two of them ate as much grain as they could clean up, which was about 1 lb. per 2.5 lbs. of milk; two others received 1 lb. of meal to 4 lbs. of milk; and the last two received 1 lb. of meal per 8 lbs. of milk. The results indicated that the cows which had the unlimited quantities of meal gave the most profit.

An experiment was tried in ensiling green alfalfa with corn. The two were not mixed, but were put in by the wagonload, in the proportion of one load of alfalfa to two of corn. The weight of the corn packed the alfalfa thoroughly, and its juices permeated it so that the alfalfa kept as well as the corn. It came out in excellent condition and was eaten with great relish by the cattle.

Ten lots of cows were fed as follows: Lots 1 and 3, peas and oats as silage; lots 2, 4, 6, and 8, peas and oats as green feed; lot 5, timothy hay; lot 7, turnips and straw; lot 9, prairie hay; and lot 10, corn silage. All the lots receiving in addition the ordinary grain ration. Judged from the standpoint of the cost to produce 1 lb. of butter the various fodders tested rated as follows: Peas and oats as silage; peas and oats as green feed; corn silage; turnips and straw; wild hay; and timothy hay. Peas and oats kept well as silage.

Fifteen head of cows were fed during four periods of 10 weeks each a ration composed of wheat bran, brewers' grains and oil cake, 5:5:2, and during two other periods, the same ration except that soy bean cake replaced the oil cake. They produced per cow per day 21.21 and 20.49 lbs. of milk having an average fat content of 3.17 and 3.09 per cent, consuming per pound of fat produced 10.95 and 11.68 lbs. of feed, and costing per pound of fat produced 35 and 36 cts., respectively. It appears that the linseed oil cake gave slightly the better results.

When cacao husks were fed in addition to a grain ration of brewers' grains and wheat bran, in the proportion of 2:5:5, the flow of milk decreased over 2 lbs. per day per cow, and the yield of fat was less. Although the total cost of the feed was less when the husks were fed the cost to produce a pound of milk or fat was increased.

Sixteen cows fed during two periods on corn silage and during another period on clover silage in addition to an ordinary grain ration, produced during the first two periods 19.61 lbs. and during the second period, 18.53 lbs. of milk per cow per day, having a fat content of 3.33 and 3.4 per cent, respectively, and costing to produce a pound of milk 1.12 and 1.14 cts.

From the results of the foregoing experiments it is recommended that linseed oil meal be fed in preference to soy-bean meal, even when combined with nitrog-

enous feeds, such as wheat bran and dried brewers' grains. If cacao-bean husks could be purchased cheaply they could be used to a limited extent to replace higher-priced grains in a succulent ration. If clover is cut when in bloom and properly made into silage it is a valuable form of winter feed for dairy cows.

Three lots of calves were fed as follows, in addition to a grain ration: Lot 1, linseed oil meal; lot 2, a commercial calf meal; and lot 3, skim milk. These calves made average daily gains per calf of 1.325, 1.038, and 1.39 lbs., at a cost per pound of gain of 8.23, 11.6, and 7.13 cts.

Cow records pay (*North Carolina Sta. Circ. 33, folio, figs. 7*).—Methods of keeping dairy records are explained, and a milk and feed record sheet is given.

Studies on the creaming ability of milk, B. W. HAMMER (*Iowa Sta. Research Bul. 31 (1916), pp. 67–91, figs. 5*).—The author found in these studies that wide variations exist in the creaming ability of various lots of milk and accordingly in the cream equivalents of 1 per cent fat. The individuality of the animal is an important factor from the standpoint of the creaming ability of milk as are also the stage of lactation of the animal and the breed.

"The temperature at which milk is held influences very materially the depth of the cream layer thrown up, low temperatures giving deeper cream layers than high temperatures. For the development of a deep cream layer on milk the milk should be held at as low a temperature as possible, although this temperature should be above the freezing point of milk. At ice-water temperature, in general, a deep cream layer is first formed and this gradually contracts as the milk stands. At room temperature, in general, a shallow cream layer is first formed and this increases as the milk stands. Commonly a definite cream layer is evident at room temperature earlier than at ice-water temperature. With the milk from individual animals low temperatures occasionally prevent the development of a definite cream layer. The original temperature ordinarily has little influence on the creaming ability of milk.

"Continued creaming tends to decrease the creaming ability of milk, although occasionally increases are observed. Continued creaming also decreases the distinctness of the cream layer. Agitation at ordinary temperatures does not necessarily decrease the creaming ability of milk and occasionally there is a slight increase. Clarification consistently causes a slight decrease in the creaming ability of milk, but this decrease is too small to be of any practical importance. Running milk through a separator and then mixing the cream and skim milk commonly causes a slight decrease in the depth of the cream layer developing on milk; the rate of the rising of the cream is also decreased. Wide variations are, however, encountered in the effect of separation on milk.

"Viscogen commonly increases the depth of the cream layer on milk and sometimes this increase is an enormous one; wide variations are, however, evident in the effect of a certain amount of viscogen. The use of viscogen to improve the creaming ability of milk can not be considered a legitimate method of increasing the depth of the cream layer. The addition of egg white commonly causes a slight decrease in the depth of the cream layer.

"A change in temperature influences the depth of the cream layer on creamed milk. With bottles a decrease in temperature increases the depth of the cream layer and an increase in temperature decreases it. With tubes a decrease in temperature increases the cream layer but an increase in temperature causes only a slight decrease which may be due simply to continued holding.

"In general, efficient pasteurization decreases the cream layer of milk. This decrease need not be a serious one if the pasteurization is properly carried out and the milk is properly held after pasteurization.

"Homogenized milk does not give a definite cream layer.

"Wide variations in the effect of the various factors on the creaming ability of milk are observed and are undoubtedly due, in part at least, to differences in the milk used."

The creamery and testers' license law. Report of the work for the year ended March 31, 1916, O. F. Hunziker and G. L. Ogle (*Indiana Sta. Circ. 55 (1916), pp. 36, figs. 4*).—This circular gives rules and regulations governing the enforcement of the Indiana creamery and testers' license law, results of inspection under the law during the year, notes on the testing of cream, notes on the location, construction, equipment, and operation of cream stations, and lists of licensed testers and plants for the year.

Effects of binders upon the melting and hardness of ice cream, C. W. Holdaway and R. R. Reynolds (*Virginia Sta. Bul. 211 (1916), pp. 19, figs. 7*).—The experiment reported in this bulletin dealt with the relative value of some of the common binders and fillers from the standpoint of hardness and heat resistance of the ice cream and also the additional effect of varying percentages of fat when used with the same.

Series of samples of ice cream from 8, 19, and 30 per cent creams were frozen in a gallon hand freezer and made into brick 3 by 4.5 by 4 in. The brick were packed in ice and salt and allowed to harden for 12 hours, all the brick containing a given percentage of fat being made from the same cream and packed in the same ice and salt. The formula for the plain or control ice cream in each series was 1 gal. of cream, 53 cc. of vanilla, and 10.5 oz. of sugar. The filler ice creams were made with each kind of cream using this basal formula and 0.4 oz. of gelatin, 1 oz. of gelatin, 0.4 oz. gum tragacanth, and 0.4 oz. of cooked starch, respectively, per gallon. At the end of the hardening period the value of each filler was determined.

The apparatus used for determining the hardness of the brick is illustrated and described. The hardness was ascertained by measuring the penetration of needles of different diameters which were let fall from a constant distance (100 mm.) and upon which a known weight was acting. This work was done in a cold storage room at 0° C.

The brick was then removed to a room having a temperature of 25°. Each brick was taken out of its mold, placed upon wooden blocks, and reduced to a standard weight of 500 gm. Weights were taken each hour for four hours to show the amount of melting.

The hardness of the different kinds of 8 and 19 per cent creams ranked in the following order from hard to soft: (1) Cream containing 1 oz. of gelatin, (2) 0.4 oz. of gelatin, (3) corn starch, (4) gum tragacanth, and (5) the control cream. The different 8 per cent creams ranked the same as the above in melting resistance. The hardness of the 30 per cent creams and the melting resistance of the 19 per cent and 30 per cent creams also ranked the same as the above, except that the control cream ranked fourth, and the gum tragacanth filler cream fifth.

Ice cream without filler from 8 and 19 per cent creams was about equal in hardness, while that from 30 per cent cream was much softer. The melting resistance increased with the percentage of fat, especially between 8 and 19 per cent. With ice cream containing gelatin, the hardest and most heat-resistant cream was that with a medium percentage of fat and a large amount of gelatin. Gum tragacanth was found to produce a smooth, soft cream. As the percentage of fat increased with this filler, the power to resist pressure and heat decreased. Corn starch as a filler compared favorably with gelatin, but the starch cream was more granular than the gelatin cream.

A few recipes are given for making ice cream, together with directions for the preparation of ingredients in ice-cream making and freezing the cream.

VETERINARY MEDICINE.

Third annual report of the commissioner of animal industry for the year ended November 30, 1914, F. F. WALKER (*Ann. Rpt. Comr. Anim. Indus. [Mass.], 3 (1914), pp. 38*).—This reports upon the occurrence of and control work with diseases of animals during the year.

Fourth annual report of the commissioner of animal industry for the year ended November 30, 1915, L. H. HOWARD (*Ann. Rpt. Comr. Anim. Indus. [Mass.], 4 (1915), pp. 62*).—The usual annual report.

[Report of the] department of veterinary science and bacteriology, W. B. MACK (*Nevada Sta. Rpt. 1915, pp. 14–19*).—In inoculation experiments conducted with equine anemia in an effort to determine whether or not it is transmissible conflicting and inconclusive results were obtained. The therapeutic work also gave negative results.

In a flock of 22 fowls in which an outbreak of chicken cholera occurred the disease was promptly checked through the injection of killed cultures of chicken cholera bacilli. In a flock of 63 birds injected twice, eight days apart, the disease was also checked, 19 having died between the treatments. Reference is made to work with contagious epithelioma in chickens, bulletins on which have been previously noted (E. S. R., 34, p. 189; 35, p. 885).

An acute disease of cattle, usually fatal, occurs in certain valleys close to the Sierra Nevada Mountains, extending along these mountains for a distance of about 150 miles. Investigations conducted have led to the conclusion that it is probably hemorrhagic septicemia.

The outbreak of rabies in neighboring States spread into northern Nevada in April, 1915. Brief reference is made to fatty degeneration of the muscles in suckling lambs in a small band of pure-bred Hampshire sheep.

A study of soy bean hay, A. C. WHITTIER (*Delaware Sta. Bul. 112 (1916), pp. 3–18*).—During the course of a feeding period of sheep and cattle in which soy-bean hay was used as a roughage much trouble was experienced in that the young animals were delivered in a weak and feeble condition which made their raising difficult, if at all possible. The trouble was abated by substituting corn fodder, hay, and silage for the soy-bean hay. This condition was deemed probably due to some constituent of the soy-bean hay, and a chemical study of the material was therefore made.

The regular feeding-stuff analysis reported does not differ in any respect from those usually reported, except in the percentage of nitrogen-free extract, which was somewhat higher. On analysis the ash was found to have the following percentage composition: Silica, 2.3; sulphur (from ash), 0.23; sulphur (wet oxidation), 0.25; sulphur soluble in 2 per cent hydrochloric acid, 0.15; phosphorus (total), 0.37; phosphorus (inorganic), 0.08; calcium, 1.21; magnesium, 0.48; potassium, 2.24; iron, 0.14; and aluminum, 0.1. The various forms of carbohydrate and nitrogenous materials present were also determined.

Examination of ligroin, ether, chloroform, and alcohol extracts showed volatile oils, glucosids, and alkaloids to be absent, thus excluding these substances as possible toxic agents of the hay.

Hydrolyses of the hay were made with water, 1, 5, 10, and 25 per cent sulphuric acid, 2 per cent sodium hydroxid, and 20 per cent hydrochloric acid, the last-named being found the best hydrolytic agent. A determination of the nitrogen distribution of the hydrolyzed material according to the Van Slyke

procedure (E. S. R., 26, p. 22) yielded the following figures: Ammonia, 7.61; melanin, 4.95; arginin, 5.81; cystin, 1.17; histidin, 8.29; lysin, 3.46; amino (in filtrate from bases), 37.3; and nonamino (in filtrate from bases), 11.17. It is indicated that the results do not show anything unfavorable in regard to the hydrolytic products of the soy-bean hay.

A substance soluble in 70 to 80 per cent alcohol and water was obtained from an alcoholic extract of the hay by precipitation with basic lead acetate. It was toxic for guinea pigs when fed with the food or injected subcutaneously. An extract obtained from alfalfa hay by a similar procedure had no effect when injected subcutaneously into a medium-sized guinea pig, thus indicating the material to be specific for soy-bean hay. The material obtained from the extract contained 19.35 per cent dry matter and 0.3 per cent nitrogen. A determination of the nitrogen distribution of the material was made, but was only partially successful.

Studies on antibodies.—I, Analyses and nitrogen distribution of a number of antisera, E. J. Banzhaf, K. Sugiura, and K. G. Falk (*Collected Studies Bur. Lab. Dept. Health N. Y. City, 8 (1914–15), pp. 213–222*).—Analytical data on the hydrogen-ion concentration, moisture, ash, phosphorus pentoxid, and nitrogen of the following antisera are submitted in tabular form, together with the formol titrations: Anti-diphtheria globulin, anti-tetanus globulin, anti-tetanus serum, anti-streptococcus serum, anti-gonococcus serum, anti-meningococcus serum, and normal serum.

Data obtained from the analysis of normal serum, tetanus globulin, diphtheria globulin, Hartley's whole protein, euglobulin (ammonium sulphate method), and euglobulin (Panum's method) by the Van Slyke procedure (E. S. R., 26. p. 22) are also reported.

No very marked differences in the composition of the different preparations were found. The only points to which attention is called are the higher values for cystin of the tetanus and diphtheria globulins.

The intrapalpebral mallein test, Goodall (*Jour. Compar. Path. and Ther., 28 (1915), No. 4, pp. 281–297, figs. 4*).—The results of the tests of a large number of military horses in Southwest Africa, together with the post-mortem findings of a number of the animals, are reported.

The intrapalpebral test is deemed a safe and reliable method in the diagnosis of glanders and far superior to the ordinary subcutaneous procedure. The advantages claimed for it over the classical subcutaneous method are summarized as follows:

Clinical cases give constant reactions to this method. Animals which had given double reactions to the subcutaneous test reacted to this method even during the height of the subcutaneous temperature curve. Doubtful reactors to the subcutaneous test can be retested by this method, and give reactions immediately afterward. Certain animals which have failed to react to the subcutaneous test, or which could not be tested by it on account of other diseases and high temperatures, can be tested by this method, and react if glandered. A safe diagnosis can be made on the local reaction alone. The local reaction is more delicate, and doubtful reactions are extremely rare. In ordinary cases temperature, local, and ophthalmic reactions can be obtained by one injection. Mules react to this test as readily as horses.

The reliability of cell proliferative changes in the diagnosis of rabies, J. B. Hardenbergh and B. M. Underhill (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 5, pp. 663–668, pls. 3*).—Investigations made of a large number of cases of suspected rabies have led to the conclusion that Negri-like bodies may occur in smear and section preparations from brains of animals dead from other causes than rabies and also in association with Negri bodies in

such preparations from rabid brains, but that true Negri bodies are only present in the central nervous tissue of animals which were suffering from rabies at the time of their death.

Experimental epidemiology in tuberculosis, A. Distaso (*Jour. Infect. Diseases, 19 (1916), No. 4, pp. 628–637*).—Experiments are reported from which the author concludes that guinea pigs can become infected through contact. The infectivity follows a curve which is nil at the beginning of the infection, increases gradually to the highest point, and is afterward no longer dangerous.

"It seems that at the beginning of the process few tubercle bacilli are excreted, with which the new contact can easily deal and acquire a kind of resistance which preserves the animal when the excretion is at its acme; but, as soon as the infection goes on and the microbes swarm in the body, then massive doses are excreted. By this time the new contact is powerless to cope at once with this large quantity, and therefore the pathogenic process establishes itself, and this is made worse by the daily absorption of great quantities of virus." This condition arose between the ninth and the thirty-third day after the infection.

"After this period a puzzling condition was observed. The guinea pigs no longer contracted the disease. It was assumed that at about this time the process of the encapsulation of the lesions began. Up to this time the virus had been wandering in the organism; after that period the organism had the power to form around the virus a wall which only let through the toxin, and perhaps a few microbes, or none, were excreted. Then the contacts could no longer be infected."

Some experimental data to substantiate the fact that the channel of infection in tuberculosis in guinea pigs is chiefly through the nose are submitted.

The relation of the results of the experimental study to the epidemiology of human tuberculosis is indicated.

A method of producing antigen for complement fixation in tuberculosis, H. R. Miller and H. Zinsser (*Proc. N. Y. Path. Soc., n. ser., 16 (1916), No. 1–2, pp. 28–30*).—The authors have prepared an antigen for complement fixation in tuberculosis by grinding a weighed amount of bacillary substance with salt and subsequent suspension in distilled water until isotonicity is obtained. The antigen so prepared is not anticomplementary in quantities as high as 1 cc., and has given positive fixation in quantities as low as 0.02 cc.

The fate of the mammalian tuberculosis bacillus in sparrows and chickens, L. Van Es and A. F. Schalk (*Jour. Infect. Diseases, 19 (1916), No. 4, pp. 614–627*).—The authors at the North Dakota Experiment Station have observed that birds (common sparrows and chickens) into which mammalian tuberculosis bacilli are introduced, either by ingestion or by inoculation, die in a highly emaciated state, but are almost entirely free from any gross lesions characteristic of the disease. The birds were found to retain the organisms for long periods with their pathogenic characteristics fully preserved.

It is indicated from the results that it is possible that birds may serve as intermediary carriers and transmitters of mammalian tuberculosis. The results confirm in part similar observations made by Auclair[1] in pigeons.

Bovine tuberculosis, C. M. Haring (*California Sta. Circ. 155 (1916), pp. 19*).—This circular discusses the subject under the general topics of susceptibility, symptoms, etiology, modes of infection, methods of detection (intradermal, ophthalmic, and subcutaneous tuberculin reactions), indications for use and limitations of the various methods, and control and suppression of the disease.

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[1] Arch. Méd. Expt. et Anat. Path. [Paris], 1. sec., 9 (1897), No. 3, pp. 277–281.

Quasi-continuous temperature records in healthy and tuberculosus bovine animals, especially in relation to the tuberculin test, P. C. V. JONES and G. S. WOODHEAD (*Jour. Compar. Path. and Ther., 28 (1915), No. 4, pp. 337–357, figs. 16*).—The authors describe in detail a specially constructed apparatus for obtaining continuous temperature records in bovines. The apparatus consists essentially of a modified platinum electrical resistance thermometer encased in a silver tube with the coil connected by means of comparatively heavy flexible leads composed of a series of strands of copper wire to the Wheatstone bridge, on which the resistance (and temperature) is measured by means of the deflection of a galvanometer.

A special harness for holding the thermometer in place so that the animal is free to assume any position has also been devised and is described.

Normal (winter and summer), pre-tuberculin period, post-tuberculin period, and late post-tuberculin period temperatures taken in the vagina by the apparatus described are submitted in graphical form.

The diastase in the saliva of the ox, C. C. PALMER (*Amer. Jour. Physiol., 41 (1916), No. 4, pp. 483–491*).—From experiments conducted at the veterinary research laboratories at the Minnesota Experiment Station it is concluded that the saliva of the ox contains a starch-splitting enzym or enzyms, the amount varying in individuals and at different times in the same individual. This enzym (or enzyms) is not a specific constituent of the saliva, but comes from the blood, which contains the same or similar enzyms in much higher concentration. The enzyms are destroyed when subjected to a temperature of about 65° C. for 1 minute. The enzym (or enzyms) is deemed to be unimportant so far as digestive ability is concerned.

An attempt to use pilocarpin hypodermically to stimulate salivary secretion was unsuccessful on account of the diastatic power of the pilocarpin on the starch. The procedure used in the experiments described was to irrigate the mouth with water or a dilute solution of acetic acid followed by inhalations of strong acetic acid.

The blood serum used was obtained by bleeding from the jugular vein in the usual manner.

A simple method of obtaining serum for the agglutination test from cattle suspected to be suffering from contagious abortion, L. E. W. BEVAN (*Jour. Compar. Path. and Ther., 28 (1915), No. 4, pp. 277–280, figs. 2*).—A tube for collecting blood for serological work which has been found to be superior to the usual pipettes used is described.

For preserving blood samples which are to be sent some distance for examination a preservative containing 3 gm. of boric acid and 0.9 gm. of sodium chlorid in 100 cc. of distilled water was found to yield satisfactory results. If it was desired to prevent coagulation the preservative solution described, but containing in addition 3 gm. of sodium citrate, was used.

The death and expulsion of the immature fetus as a standard for measuring the prevalence of cattle abortion, W. L. WILLIAMS (*Jour. Amer. Vet. Med. Assoc., 50 (1916), No. 1, pp. 29–40*).—A paper presented at the annual meeting of the American Veterinary Medical Association at Detroit, Mich., August 22, 1916.

The outlook for the control of cattle abortion, W. L. WILLIAMS (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 2, pp. 199–217*).—A further discussion of this subject (E. S. R., 34, p. 386).

Case reports of lymphangitis in cattle caused by an acid-alcoholic-fast organism, J. TRAUM (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 2, pp. 254–257, pl. 1*).—Reports are given of cases of lymphangitis of cattle which showed the

presence of acid-fast organisms that are more closely related to the streptothrix than are the mammalian tubercle bacilli.

The liver fluke disease, its treatment and control, J. MAREK (*Berlin. Tierärztl. Wchnschr., 32 (1916), Nos. 7, pp. 73–77; 8, pp. 85–90, figs. 4; 9, pp. 97–101, figs. 3; abs. in Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 4, pp. 534, 535*).—Tests were made of a number of bactericidal and parasiticidal substances thought to be taken up by the intestine and returned in the bile, but in all cases (steers and sheep) the flukes remained alive. Successful results, however, were obtained from the use of kamala and its preparations, either kamala depuratum or kamala venale being satisfactory. Fifteen gm. administered in two doses at 12 to 24 hour intervals to yearlings and older sheep, or divided into five doses for weak ones, were found to destroy the flukes in from three to eight days. The treatment of cattle with kamala was beneficial but not so satisfactory as in sheep.

The abstract is by M. C. Hall.

Investigation into "louping-ill" or "trembling," J. P. M'GOWAN (*Edinburgh: William Blackwood & Sons, 1915, pp. 51*).—"Louping-ill or trembling, according to the view propounded here, is divisible into two groups, true louping-ill and pseudolouping-ill. True louping-ill (which includes staggers or stomach staggers of hill farms and arable farms) is divisible into several varieties, as mentioned in the text. Specially, according to the view expressed here, does it include braxy or sickness and grass sickness, which are held to be the very acute forms of the disease. The disease milk sickness in lambs is considered also to be a variety of this same disease. . . .

"These diseases are considered to be essentially of the same nature, in that they are held to be caused by the same organism, *Bacillus bipolaris septicus ovium*. Epidemiologically they are considered to be different, in that while braxy is usually produced by eating rapidly large quantities of succulent material covered with hoar frost, true louping-ill in most of its varieties is considered to be caused chiefly by exposure to extreme degrees of temperature within a short interval. Milk sickness is considered to be in a restricted degree caused by contagion. The grass tick is held to be responsible for the production of the bulk of the cases of pseudolouping-ill. Navel-ill, with its attendant joint-ill, contributes some cases, while aggravated wool-ball, injuries, etc., add a few to the sum total included in this term. A discussion on possible means of prevention and treatment is embodied in the text."

Additional notes on pathological lesions of pigs fed rice meal, S. HADWEN (*Canada Expt. Farms Rpts. 1915, pp. 573, 574*).—This is an amplification of the findings reported the previous year (E. S. R., 33, p. 775). The author's view that toxins are responsible for the lesions encountered, expressed in the previous report, is said to have been supported by subsequent examinations, although incomplete nutrition is the primary cause of the disease. He finds that as a result of malnutrition the alimentary tract does not function normally and toxic products are absorbed into the system. Four pigs which received phosphorus in addition to rice meal and grew well furnished a striking contrast to others which received no phosphorus, the latter having developed a neuritis and lost the use of their limbs.

Notes on the occurrence of petechial hemorrhages in the larynx and kidneys in hog cholera, H. P. HOSKINS (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 4, pp. 478–483, fig. 1*).—"If we are to continue classifying hog cholera in the group of septicemic diseases, and accept the hemorrhagic lesions found in the kidneys, lymph nodes, intestines, bladder, lungs, etc., as a part of the pathological picture of this disease, the hemorrhages found in the mucous

membrane of the larynx should also be considered along with the other lesions mentioned.

"Hemorrhagic laryngitis has been found in about three-fourths of a series of 500 pigs, killed subsequent to inoculation with hog-cholera virus, these hemorrhagic lesions being in evidence most regularly in those animals killed and autopsied eight to eleven days after inoculation. In view of the fact that petechial hemorrhages in the kidneys occur in a number of different pathological conditions, veterinarians should be cautious about basing a diagnosis on this lesion alone, even though this lesion does appear in a very large percentage of cases of hog cholera due to the filterable virus."

Observations on 2,800 pigs inoculated with hog-cholera virus, H. P. Hoskins (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 6, pp. 817–829, fig. 1*).—Observations and experiments on 2,800 pigs inoculated for the production of hog-cholera virus at the Minnesota state serum plant over a period of approximately two years are reported.

Of the pigs inoculated 390 (13.9 per cent) failed to succumb to the infection, and their reactions varied between wide limits, indicating all grades of susceptibility and immunity to hog cholera. No pig survived a temperature higher than 107.4° F. Only 8 per cent of the pigs weighing between 40 and 50 lbs. survived the inoculation, thus indicating the greatest susceptibility at this weight. Pigs weighing between 50 and 60 lbs. at the time of inoculation showed the greatest resistance. The resistance was found to slowly decrease, however, as the pigs became heavier. Pigs which failed to succumb reached the height of their reaction most frequently on the sixth day. Animals which died or were killed when moribund reached the height of their reaction most frequently on the seventh day.

A virus was obtained ("fixed virus") which could be depended upon to bring pigs down on the eighth day with a fair degree of regularity by frequent passages of a strain of virus through susceptible pigs and by carefully selecting the seed virus pig from each group. Pigs inoculated with virus of different ages up to 162 days succumbed quite regularly within a few days of the time necessary for the same virus to bring the pigs down when comparatively fresh. Virus 216 days old had lost its infectivity. Pigs inoculated with various amounts of the virus (1 to 10 cc.) came down in the regular time, regardless of the exact amount injected or the manner of introduction.

Failure to succumb is considered by the author to mean that the pigs either did not die of the disease or did not at any time become sick enough to warrant slaughter for the purpose of obtaining virus.

The attenuation of hog-cholera virus, D. J. Healy and E. J. Gott (*Jour. Infect. Diseases, 19 (1916), No. 4, pp. 569–571*).—The authors at the Kentucky Experiment Station, continuing the work on the etiology of hog cholera, report experiments in which the virus of the disease was so modified by incubation for 48 hours at 37° C. with hyperimmune blood that when injected it no longer rendered normal hogs sick but even protected them when they were later exposed to infection. The cholera virus incubated with normal rabbit serum for 48 hours at 37° was modified to the extent that one of three animals was protected against the disease.

It is indicated that "it is quite possible that the mixture of hog-cholera virus and hyperimmune blood which had been modified by incubation for 48 hours at 37° and then rapidly dried over sulphuric acid at a low temperature would indefinitely retain its power to protect hogs against cholera, and yet not sicken them."

Some points in connection with the pathology and epidemiology of swine fever, J. P. M'Gowan (*Edinburgh: William Blackwood & Sons, 1915, pp. 40*).—"From investigations conducted on material obtained from three epidemics of swine fever, the view is enunciated here that *Bacillus suipestifer* may vary considerably in its biological reactions, and may even be considered to be a variant of *B. suisepticus*."

Paralysis of pigs, H. Wehrbein (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 2, pp. 238–244, pls. 2*).—A disease. commonly known as paralysis, which has proved to be a polyneuritis parenchymatosa, is endemic in Iowa, where it causes quite considerable losses. "Because of the course and the nature of the disease therapeutic measures are not advised, but prophylactically the elimination from breeding of all animals the offspring of which repeatedly incline to the disease, and of all diseased animals, even when recovered, and the eventual change to dry quarters and proper feed will most likely be successful."

Parasites of hogs, K. W. Stouder and W. E. Simonsen (*Iowa State Col. Agr. Ext. Bul. 43 (1916), pp. 8, figs. 2*).—A brief popular account of the more important parasites affecting swine.

Shipping fever of horses, J. R. Mohler (*Jour. Amer. Med. Vet. Assoc., 49 (1916), No. 2, pp. 169–178*).—A review of the present status of knowledge of this disease, including reference to work by the Bureau of Animal Industry of the U. S. Department of Agriculture.

Experiments by this bureau are said to give support to the view that the *Streptococcus equi* of Shütz is the cause of strangles, the filterable virus of Poels the agent of influenza, and the cellular inclusions of Gaffky and Lührs the causal factors of contagious pneumonia. The bureau's experiments have demonstrated clearly that the filtered blood of influenza cases is capable of reproducing the disease in susceptible horses, while the inoculations of various bacteria recovered from such cases have thus far proved negative.

"The preponderance of evidence appears to be in favor of an ultravisible micro-organism as the cause of influenza, the lowered vitality occasioned by this virus paving the way to infection with the colon bacillus, coccobacillus, *Bacillus necrophorus*, *B. pyocyaneus*, staphylococcus, pneumococcus, and most important of all the various species of Streptococcus. . . . The action of the bacterial vaccines as used at the present time is chiefly to assist in preventing or controlling the secondary infections which are invariably associated with influenza, and this opinion is substantiated by the fact that the influenza vaccines when injected in the early stages of the disease frequently result in a mild type of an attack with shorter duration."

A new disease in ducklings, F. C. Elford (*Canada Expt. Farms Rpts. 1915, pp. 1119, 1120*).—Numerous complaints were received during the summer of 1914 of a disease of ducklings from widely separated districts. One newly established commercial plant lost large numbers of ducklings that had been procured in the United States for foundation stock. The age at which they were shipped did not seem to make any difference, as apparently all were affected in the same manner.

Investigations showed that the trouble was not confined to ducklings, as growing ducks about six weeks of age were sometimes affected, though in the more mature ducks the symptoms were more pronounced and were often noticeable for some time before death. The disease is characterized by a discharge from the eyes and sometimes from the nostrils, and there appears to be an affection of the brain, as the head is thrown back until it touches the shoulders, the duckling often staggering backward until it falls over. In some cases the ducklings seemed to recover, although it was noticeable that under

excitement some of the symptoms were liable to recur and the ducklings would be taken with spasms while swimming and drown. In examinations made Wickware detected the presence in the blood of all affected cases of a parasite, which gradually disappeared as recovery took place. Further studies are necessary before the cause of the disease can be fully determined. See also a previous note (E. S. R., 33, p. 483).

The transmission of filaria by Chrysops, F. K. Kleine (*Zschr. Hyg. u. Infektionskrank., 80 (1915), No. 3, pp. 345–349*).—This paper relates to studies made in West Africa, where tabanids of the genus Chrysops, namely, *Chrysops dimidiata* and *C. silacea*, were proved to be capable of transmitting *Filaria loa*.

A new host for Fasciola magna, together with observations on the distribution of F. hepatica in Canada, S. Hadwen (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 4, pp. 511–515, figs. 5*).—The coast deer (*Odocoileus columbianus*) is said to be a new host for *F. magna*. The liver taken from a host on Texado Island in the Straits of Georgia contained 18 large flukes. *F. hepatica* has long been a source of loss of coast sheep in British Columbia but is not known to occur elsewhere in Canada.

The occurrence of the giant nematode, Dioctothyme renale (Eustrongylus) in the United States and Canada, W. A. Riley (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 6, pp. 801–809*).—Twenty-three definite cases of the occurrence of the giant nematode *D. renale* (*gigas*) in the United States and Canada are reported, of which 19 are here recorded for the first time.

RURAL ENGINEERING.

Rural engineering and the war of 1914–1916, M. Ringelmann (*Ann. Sci. Agron., 4. ser., 4 (1915), No. 10–12, pp. 296–381, figs. 44*).—This is an extensive report on the influence of the European war on rural structures, rural hydraulics, and agricultural machinery in France.

Surface water supply of south Atlantic and eastern Gulf of Mexico basins, 1914 (*U. S. Geol. Survey, Water-Supply Paper 382 (1916), pp. 66+XXX, pls. 2*).—This report presents the results of measurements of flow made during 1914 on the James, Roanoke, Pedee, Savannah, Altamaha, Apalachicola, Escambia, and Mobile rivers.

Surface water supply of Snake River basin, 1914 (*U. S. Geol. Survey, Water-Supply Paper 393 (1916), pp. 248, pls. 2*).—This report, prepared in cooperation with the States of Idaho, Oregon, Nevada, and Washington, presents the results of measurements of flow made on the Snake River and its tributaries during 1914.

Well waters from farm homesteads, F. T. Shutt (*Canada Expt. Farms Rpts. 1915, pp. 163–169*).—Analyses of 195 samples of Canada farm water supplies are reported, showing that 49 were pure and wholesome, 54 suspicious and probably dangerous, 36 very seriously polluted, while 56 samples were too saline for potable use.

"The cause of pollution in the larger number of instances is the access to the well of drainage of an excretal character from the stable, barn, or privy. The polluted wells, for the most part, are shallow, merely collectors of soakage water from the surrounding soil. When these wells are, for the sake of convenience, located near the farm buildings or in the barnyard, as is too frequently the case, contamination is practically inevitable.

"The bored or drilled well, tapping a deep-seated source, is undoubtedly safer and more reliable than the shallow, ground-water well. Where the latter must be relied on, the surroundings for a radius of, say, 50 yds. should be kept free from manure and filth. Preferably this area should be sodded. As a further

precautionary measure the shallow well may be lined to a depth of 10 or 12 ft. and to a thickness of, say, 4 to 6 in. with cement or puddled clay, the lining projecting, say, 6 to 12 in. above the mouth of the well, which should be protected with a well-fitting cover to keep out frogs, mice, etc."

Boiling of water and treatment with hypochlorite are discussed.

Flow of water into wells: Approximate theory, N. WERENSKIOLD (*Engin. News, 76 (1916), No. 6, pp. 256, 257, figs. 2*).—A formula is derived from mathematical analysis for finding the rate of flow of water into open wells.

Experience with wood pipes in New Hampshire, A. W. DUDLEY (*Jour. New England Water Works Assoc., 30 (1916), No. 3, pp. 318–323, pls. 2*).—Summarizing experience with wood pipe for water supply, the author states that it possesses the following advantages:

"(1) It is preserved and not rusted or corroded by water. (2) It is not corroded by any substance or destroyed by acids or salts. (3) Its carrying capacity is 20 per cent greater than cast-iron pipe and remains constant, while that of metal pipe decreases with age. (4) It does not taint or affect fluids going through it. (5) It does not burst if frozen, the elasticity of the wood preventing it. (6) It requires less labor and experience to lay in place than metal pipe. (7) It can, when service pipes are not taken off, be laid in shallower ditches than metal pipe, for it is not easily affected by frost. (8) While more or less joints show slight leakage when the pipe is first filled, they soon swell up and give less trouble in the end than cast-iron pipe."

Influence of the algæ of submerged sand filters in water purification, F. DIÉNERT and L. GIZOLME (*Compt. Rend. Acad. Sci. [Paris], 163 (1916), No. 5, pp. 127–130*).—Experiments are reported, the results of which are taken to indicate that the purifying action of a submerged sand filter on water is a function of the development and vitality of the biological covering of algæ. This activity is thought to be measured by the reduction of the alkalinity of the water, especially with reference to the coli bacteria.

Waterworks handbook, compiled by A. D. FLINN, R. S. WESTON, and C. L. BOGERT (*New York: McGraw-Hill Book Co., 1916, pp. IX+824, figs. 411; rev., in Engin. and Contract., 46 (1916), No. 6, pp. 123, 124*).—This book gives an extensive and usable compilation of information, old and new, for the waterworks engineer and superintendent, the designer, constructor, operator, and inspector. It is divided into five parts.

Part 1, sources of water supply, deals with rainfall or precipitation, evaporation, run-off and stream flow, and ground water. Part 2, collection of water, deals with intakes, watershed development by reservoirs, masonry dams, rock-fill dams, earth dams, wells, infiltration galleries, and notes on some equipment for treating water. Part 3, transportation and delivery of water, deals with open channels, aqueducts, plate metal pipes, wooden pipes, and reinforced concrete pipes. Part 4, distribution of water, deals with cast-iron pipe and specials; distribution systems; valves, sluice gates, and hydrants; service meters; pumps, pumping stations, and equipment; distribution reservoirs, standpipes, and tanks; water consumption; hydraulic computations; masonry and puddle; nonferrous metals (also corrosion of iron and steel); capacity and conversion tables; and miscellany. Part 5, character and treatment of water, deals with character of water; inspection of sources of supply, storage of water and improvement of reservoirs, sedimentation, aeration and chemical treatment, water softening, preliminary filtration and deferrization, filtration, and examination of water.

Methods and cost of making a snow survey for irrigation system, F. T. CUMMINGS (*Engin. and Contract., 46 (1916), No. 9, pp. 189–192, figs. 3*).—This

article describes the methods and cost of making a snow survey, made in cooperation with the Weather Bureau of the U. S. Department of Agriculture, and reports the data obtained.

Subirrigation, A. P. SPENCER and C. M. BERRY (*Univ. Fla. Div. Agr. Ext. Bul. 5 (1916), pp. 12, figs. 8*).—This circular describes and illustrates methods of subirrigation employed in Florida in artesian areas.

The essentials for successful subirrigation are enumerated as (1) an abundant supply of water, (2) a subsoil or floor composed of clay, marl, or hardpan located at a depth of from 3 to 5 ft. below the surface to hold the water and prevent its escape downward; (3) a foot or more of coarse sand on top of the subsoil or bottom of the irrigated depth that will readily absorb and distribute evenly the water to be used in grading the artificial water table; (4) a topsoil of sandy loan that is neither too porous nor too compact and which will convey the water freely by capillary attraction; (5) land that admits perfect drainage [and has] a fall of about 1 in. to 100 ft.; and (6) land that is level, without depressions or raised places.

"Wherever the foregoing conditions obtain and wherever the crops to be grown justify it, subirrigation should give satisfactory results, but with any one of these essentials lacking it is not likely to give satisfaction. The system also supplies drainage and aeration."

In the construction of a system a water main with supply pockets is located on the high side of a field. The supply pockets feed the irrigation tile which drain into stop pockets at the low side of the field which are connected with a drain.

Cost of pumping for irrigation, O. L. WALLER (*Washington Sta. Popular Bul. 104 (1916), pp. 11*).—This bulletin gives brief directions for the designing of an irrigation pumping plant and estimating the cost of plant and of pumping water, together with experimental data on the use of fuel or electricity in pumping.

The following table shows the number of gallons of gasoline, distillate, or crude oil and the kilowatt hours of electrical energy used under average farm conditions and practice to lift 1 acre-foot of water 1 ft. high.

Fuel and electricity used for irrigation pumping.

Gallons of gasoline, distillate, or crude oil used.					Kilowatt hours of electric current used.		
Horsepower required.	Engine belted to a centrifugal pump.		Engine belted to a deep-well pump.		Horsepower required.	Kilowatt hours used.	Efficiency.
	Fuel used.	Efficiency of plant.	Fuel used.	Efficiency of plant.			
	Gallons.	*Per cent.*	*Gallons.*	*Per cent.*			*Per cent.*
2	1.14	0.15	1.80	0.10	2.5	3.25	0.31
3	.94	.18	1.20	.15	5.0	2.85	.35
4	.83	.20	.91	.19	7.5	2.50	.40
5	.76	.23	.79	.22	10.0	2.35	.42
6	.70	.26	.70	.25	15.0	2.20	.45
7	.66	.27	.63	.27	20.0	2.05	.49
8	.62	.28	.58	.30	25.0	1.90	.52
10	.58	.29	.53	.33	30.0	1.80	.55
12	.57	.30	.49	.35	35.0	1.70	.59
15	.55	.31	.45	.38	40.0	1.65	.60
20	.51	.34	.40	.43	50.0	1.60	.62
25	.48	.36	.36	.48			
30	.45	.38	.33	.52			
35	.42	.41	.29	.60			

A list of 10 references to literature bearing on the subject is appended.

Cost of structures of the second unit of the Dodson north canal, Milk River Irrigation Project, Malta, Montana, A. E. Bechtel (*Engin. and Contract., 46* (*1916*), *No. 6, pp. 126–129, figs. 16*).—Tables of cost data are given, together with descriptions and illustrations of the structures.

Irrigation of Thanh-Hoa, Peytavin (*Bul. Écon. Indochine, n. ser., 19* (*1916*), *No. 117, pp. 13–55, pl. 1*).—The important features of an irrigation system in the residency of Anam in French Indo China are described.

The district covers 105,000 hectares (259,350 acres), of which 70,000 hectares are actually irrigable. The amount of water necessary is estimated at about 0.64 to 0.8 liters per second per hectare, making a total quantity of water, including rainfall, of 0.77 to 1.65 liters per second per hectare. The cost of the system is estimated at 12,000,000 francs (about $2,316,000).

Irrigation practice in growing small fruits in California, W. A. Hutchins (*California Sta. Circ. 154* (*1916*), *pp. 35, figs. 17*).—This circular describes and analyzes irrigation practices in the important berry centers of the State, and is based on work done under cooperative agreements between the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture and the California State Department of Engineering and between the Office of Public Roads and Rural Engineering and the station.

Utilization of small waterfalls for drainage and irrigation, V. N. Rostovtsev (Rostovtseff) (*Selsk. Khoz. i Lîesov., 250* (*1916*), *Feb., pp. 179–223, figs. 25*).—Several different types of hydraulic ram are described and illustrated.

Tile drainage, A. H. Leidigh and E. C. Gee (*Texas Sta. Bul. 188* (*1916*), *pp. 26, figs. 18*).—This bulletin, written from the viewpoints of both the engineer and the agronomist, gives general information on methods, requirements, and results of tile drainage in Texas.

Ditching and digging pole holes with dynamite, T. M. Knight (*Engin. and Contract., 46* (*1916*), *No. 3, pp. 66–68, figs. 7*).—Descriptions of methods employed, together with diagrammatic illustrations and tabular data, are given.

Land clearing, P. H. Moore (*Canada Expt. Farms Rpts., 1915, pp. 351–354, pls. 2*).—The average cost per acre for clearing ready to plow 14 acres of Douglas fir, birch, maple, alder, and vine maple with thick undergrowth, was $145.39. Pulling of stumps by cable and blocks after light blasting was found to be more economical than direct hauling. Burning was less expensive for felling trees than sawing, although the stump was frequently removed at greater expense. Splitting with explosives and burning was found to be the best method of handling a big tree after it is down.

Major results of stump removal investigation conducted by the University of Wisconsin, C. D. Livingston (*Engin. and Contract., 46* (*1916*), *No. 3, pp. 53, 54*).—Work conducted by the agricultural engineering department of the University of Wisconsin established the following points as good practice in stump clearing:

"Where the stumps are large it was found that from one-third to one-fourth the amount of dynamite necessary to entirely remove the stumps from the ground would crack them into several pieces so that one or more of them could be pulled. Stumps may be pulled easier and quicker when cracked. The hole left is not nearly so large as when either pulled whole or blown out entirely. The roots are cleaner, are easier to handle, dry quicker, and are more easily burned. On the loams and clays it was found that 20 per cent dynamite would do the same work as 40 per cent at a saving of 25 per cent on the dynamite bill. On the lighter soils the 30 per cent grades did as good work as the high kinds and cost about 10 per cent less. Forty per cent grades or higher are only needed on dry sands.

"Electrical blasting was found to be quicker to operate and far more safe than the old cap and fuse method. By the use of a blasting machine many charges may be detonated at the same time, either under the same or different stumps. This method enables the charges to be placed where they are most needed. The holes left are usually smaller and the cost is not greater when the results are taken into consideration. Stump pilers are necessary to efficient land clearing where mechanical pullers are used. When they are equipped with automatic tripping devices piling may be done at the same time as the stumps are being burned. When stumps are dropped on a burning pile a more complete burn is secured; some dirt may be left on the roots and they may be much greener and still burn. The jar of falling stumps is like continually poking a grate fire. . . .

"Explosives are extremely valuable in certain kinds of ditching work. No matter how wet, brushy, or stony the ditch line may be, if sticks of 60 per cent straight nitroglycerin dynamite can be located within 18 in. of each other in wet ground a serviceable open ditch can be made by the detonation of only one cartridge."

State highway mileage and expenditures for the calendar year 1915 (*U. S. Dept. Agr., Office Sec. Circ. 63* (*1916*), *pp. 8, fig. 1*).—Considerable tabular data are reported on road expenditures and highway mileage during 1915, and a review of such matters for the past 12 years is given.

"During 1915 the total road and bridge expenditures in the United States amounted to about $282,000,000, of which probably not over $15,000,000 represented the value of the statute and convict labor performed on the roads. Of the cash expenditures of $266,976,399, about $40,000,000 was secured from local bond issues and $53,491,651 from State funds. . . . A total of $80,514,699 was expended under the supervision of the State highway departments in the construction of 12,437 miles and the maintenance of 51,769 miles of public roads.

"In 1904 the actual cash road and bridge expenditure in the United States averaged slightly less than $28 per mile of rural roads. In 1915 the cash road and bridge expenditure had increased to an average of $109 per mile of road, and while in 1904 New Jersey led the States with an average road expenditure of $221 per mile, and Nevada was last with $3.72 per mile, in 1915 New Jersey again had the highest expenditure of $475 per mile of rural road and Nevada was last with approximately $17 per mile.

"While the total road and bridge expenditures have increased about three and one-third times during the last 12 years—the portion secured from local bond issues about eleven times and that from State funds twenty times—on the other hand, the portion of this expenditure secured from statute labor has decreased about one-half. Furthermore, in 1904 practically all of the State funds were applied to road construction, not to exceed 3 per cent being devoted to maintenance, while in 1915 about $16,000,000, or 30 per cent, of the State funds were applied to maintenance and reconstruction. . . .

"During 1915 those States having State highway departments surfaced under such supervision about 8,000 miles, and also improved, by grading and otherwise, an additional 4,000 miles. Thus, of the really constructive road work in the United States last year about one-half was more or less directly under competent State supervision. In addition to this work of construction, the several state highway departments also supervised the maintenance of 51,769 miles of main and trunk line roads."

Proceedings of the thirteenth annual convention of the American Road Builders' Association (*Proc. Amer. Road Builders' Assoc., 13* (*1916*), *pp. X+264*).—The following special articles are included in these proceedings: Recent Development in the Building of Concrete Roads, by W. D. Uhler; A Con-

tractor's Suggestion to Engineers and Inspectors, by J. H. Gordon; Different Conditions and Localities, by F. C. Pillsbury; Roads at Low Cost for Moderate Traffic, by F. E. Everett; Foundations for Road and Street Pavements, by J. W. Hunter; Brick Streets and Roads, by H. E. Breed; Recent Tendencies in Stone Block Pavements, by C. F. Knowlton; and The Functions Performed by Stone in the Bituminous Concrete Pavement, by R. B. Gage.

Unit stresses for timber: Manufacturers' table (*Engin. News, 76 (1916), No. 6, p. 273*).—Working unit stresses for structural timbers used in dry locations are given in the following table:

Working unit stresses for structural timbers used in dry locations.

Species of timber.	Bending.		Compression.	
	Stress in extreme fiber, per square inch.	Horizontal shear per square inch.	Parallel to grain "short columns," per square inch.	Perpendicular to grain, per square inch.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Fir, Douglas:				
Dense grade	1,600	100	1,200	350
Sound grade	1,300	85	900	300
Hemlock, eastern	1,000	70	700	300
Hemlock, western	1,300	75	900	300
Oak	1,400	125	900	400
Pine, eastern white	900	80	700	250
Pine, Norway	1,100	85	800	300
Pine, southern yellow:				
Dense grade	1,600	125	1,200	350
Sound grade	1,300	85	900	300
Spruce	900	70	600	200
Tamarack	1,200	95	900	350

New dairy cattle barns, E. S. Archibald (*Canada Expt. Farms Rpts. 1915, pp. 418–424, pls. 9*).—Plans, photographs, and brief specifications for the dairy barns recently constructed at the Central Experimental Farm at Ottawa, Ontario, Canada, are given.

The homemade stave silo, J. N. Price (*Wash. State Col. Ext. Dept., Ser. 1, No. 24 (1916), pp. 16, figs. 18*).—It is the purpose of this publication to give bills of material, illustrations and full instructions for building the stave silo with either plain or tongued and grooved staves and with either of the two types of doors.

Pit silos and how to make them, A. L. Paschall (*Ariz. Col. Agr. Ext. Serv. Circ. 8 (1916), pp. 28, figs. 22*).—This circular contains a compilation of the experiences of farmers in Cochise and Santa Cruz counties, Ariz., with pit silos, together with information on the subject from several of the state agricultural experiment stations.

RURAL ECONOMICS.

Can the farmer realize higher prices for his crops by holding them? J. E. Pope (*Quart. Jour. Econ., 30 (1916), No. 4, pp. 805–831*).—The author, after studying the variation in the monthly prices of important agricultural products, the cost of storage, interest, and other expenses of holding crops, concludes that in the long run it will not pay the farmer to follow this practice.

Marketing farm produce by parcel post and express, B. H. Hibbard and A. Hobson (*Amer. Econ. Rev., 6 (1916), No. 3, pp. 589–608, figs. 8*).—The authors point out that it is feasible to market only a small portion of the farm products

by these methods and compare parcel-post and express rates and the limitations in their service.

The intrinsic values of grain, cotton-seed, flour, and similar products, based on the dry-matter content, E. G. BOERNER (*U. S. Dept. Agr. Bul. 374 (1916), pp. 32, figs. 3*).—In this report is pointed out the fact that the water contained in grain, cotton seed, and similar products adds nothing to their intrinsic value, while in many ways the excess of moisture is detrimental. The methods of determining the comparative value of dry matter and the advantages of buying and selling on a dry-matter basis are discussed. A series of statistical tables are included, showing the comparative values, on a dry-matter basis, with varying moisture contents.

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt., 2 (1916), No. 9, pp. 85–96, figs. 4*).—This report contains the usual data regarding crop conditions, estimated farm values of important farm products, and range of prices of agricultural products at important markets, and special reports and data on hogs, honey bees and honey plants, cotton, pecans, rice, cranberries, and beans, onions, cabbage, and other truck crops. It also shows the estimated apple crop by varieties, and the wheat production in some of the principal wheat-producing countries of the world. There is also shown a diagram giving the variation in prices of hogs and corn over a series of years.

Statistical tables relating to wheat, G. F. SHIRRAS (*Dept. Statis. India, Statis. Tables Wheat, 1916, pp. II+32, pls. 4*).—In this report are given the area and yield of wheat in India by Provinces and in selected countries, the imports and exports, and the monthly movement and prices, together with the trade of the United Kingdom.

Farmers' cooperative corporations, A. E. CANCE and L. J. JEFFERSON (*Bul. Vt. Dept. Agr., No. 24 (1915), pp. 48*).—The authors have discussed the essentials of successful cooperation, the fundamentals of a cooperative corporation, possible fields for cooperation among farmers, standardization, federation of cooperative societies, and how to form farmers' exchanges. There are also included forms for incorporating and for organizing cooperative organizations. A brief bibliography is appended.

Eugenics and agriculture, O. F. COOK (*Jour. Heredity, 7 (1916), No. 6, pp. 249–254*).—The author maintains that city life sterilizes the best lines of descent on a large scale, and therefore that population must be held on the farm if the race is to improve.

The article concludes with the statement that "to recognize the relation of eugenics to agriculture does not solve the problems of our race, but it indicates the basis on which the problems need to be solved, and the danger of wasting too much time and effort in attempting to salvage the derelict population of the cities. However important the problems of urban society may be, they do not have fundamental significance from the standpoint of eugenics, because urban populations are essentially transient. The city performs the function of elimination, while agriculture represents the constructive eugenic condition which must be maintained and improved if the development of the race is to continue."

Community centers, R. V. PHELAN (*Bul. Univ. Minn. No. 25 (1915), Gen. Ser., pp. 15, figs. 6*).—This pamphlet contains a proposed model constitution, suggestions as to the purpose of organization, methods of organization, and topics for discussion and study.

The church and country life, edited by P. L. VOGT (*New York: Missionary Ed. Movement U. S. and Canada, 1916, pp. XI+273*).—This is a report of a conference held by the Commission on Church and Country Life under the authority of the Federal Council of Churches of Christ in America, at Columbus,

Ohio, in December, 1915, and contains the reports of the different committees appointed by the commission. See also a previous note (E. S. R., 34, p. 297).

Country life questions and answers (*Missouri Bd. Agr. Mo. Bul., 14 (1916), No. 4, pp. 89, fig. 1*).—This bulletin contains a number of papers dealing with the problems of the rural school, the country church, and various other phases of country life.

Bibliography on country life, the farm, and the small town (*Ind. State Libr. Bul., 10 (1915), No. 4, pp. 11*).—This bibliography contains a list of publications dealing with these three topics in general and with special phases, such as the rural church, the rural school, roads, health and recreation, cooperation, buildings, grounds, machinery, the home, town planning and beautifying, sanitation, fire protection, business, and organizations.

Rural progress in Missouri, W. L. Nelson (*Missouri Bd. Agr. Mo. Bul., 14 (1916), No. 3, pp. 29, figs. 2*).—This bulletin discusses the relative efficiency of farmers in Missouri as compared with other States, using the Census data as a basis.

Statistical report of the California State Board of Agriculture, 1915 (*Statis. Rpt. Cal. Bd. Agr., 1915, pp. XXII+435*).—This report contains a brief description of the physical and agricultural conditions in California by counties, with detailed statistics relative to agricultural production.

[Agricultural resources of Rhode Island] (*Prelim. Rpt. Com. Inquiry Agr. Resources R. I., 1916, pp. 30*).—This is a preliminary report of the Commission of Inquiry into the Agricultural Resources of the State, made to the General Assembly, and indicates how the agricultural conditions in the State may be improved through cooperation among the farmers and between the various organizations already existing. The principal production and marketing problems in connection with the present systems of agriculture are described, especially as they relate to the dairy industry.

The agricultural situation in the Philippine Islands, H. T. Edwards (*Philippine Agr. Rev. [English Ed.], 9 (1916), No. 2, pp. 69–73*).—The author calls attention to the changes in the area devoted to the production of rice, corn, coconuts, sugar, tobacco, and Manila hemp, and to the changes in the number of live stock. He also discusses the relationship of the government work to the development of the agriculture of the islands.

The farm prize competitions, C. S. Orwin (*Jour. Roy. Agr. Soc. England, 76 (1915), pp. 201–237, figs. 7*).—This article contains a brief description of the agriculture of the counties of Derbyshire, Leicestershire, and Nottinghamshire, and of the systems of management on farms awarded the prizes. The farms were divided according to the systems of management into two classes—the arable and the grazing or dairy farms.

Agricultural statistics of Galicia and Bukowina, 1914 (*Anbauflächen und Ernteergebnisse der landwirtschaftlichen Bodenprodukte in den im Reichsrate vertretenen Königreichen und Ländern mit Ausnahme Galiziens und der Bukowina, 1914. Vienna: Govt., 1915, pp. 49*).—This report contains statistical data concerning the acreage and production of the principal agricultural crops of Galicia and Bukowina for 1914, with comparisons for earlier years.

[Agriculture in the Commonwealth of Australia], G. H. Knibbs (*Off. Yearbook Aust., 8 (1901–1914), pp. 221–386, figs. 5*).—These pages contain the information previously noted, with data for a later year (E. S. R., 33, p. 193).

AGRICULTURAL EDUCATION.

A state system of agricultural education, K. L. Butterfield (*Mass. Agr. Col. Bul., 8 (1916), No. 2, pp. 29–47*).—A brief review of the history of agricultural education in Massachusetts, beginning with the incorporation by the legislature

in 1792 of the Massachusetts Society for the Promotion of Agriculture, which still exists, is followed by a discussion of some characteristics of a state system of agricultural education, the types of work to be recognized, the groups of persons to be reached, and the scope and administration of and necessary machinery for agricultural education.

County training schools in Alabama, J. L. Sibley (*South. Workman, 45 (1916), No. 7, pp. 407–412, figs. 6*).—This article describes a new type of school for negro youth, known as the county training school, which is being developed in the South in cooperation with a number of educational agencies.

The schools cover from 8 to 10 grades of work and offer three courses, viz, agriculture for boys, household arts for girls, and teacher training during the last year for those who desire to teach in the rural schools of the county. In Alabama three schools are already in operation.

As soon as funds permit each school is to have a teacher's home so that the school can be made the center of community life. The aim has been to secure some 10 acres of land for the school site and small demonstration plat. Extensive agricultural work is not to be done on the school grounds, as it is thought that club work with boys and girls at their homes and demonstration work with their parents will prove more effective.

The principals and industrial teachers are employed by the year, the purpose being to have them work in the community during the summer vacation months. During the past two years annual farmers' conferences, annual county teachers' institutes, and community fairs have been held at the schools. Two of the schools will give short summer courses for teachers now at work in the county. A supervising industrial teacher makes her nominal headquarters at the school, but works mainly out in the rural communities. One or two days of each month she devotes to the training school, helping the teachers in their industrial classes, and addresing the students on the needs of the rural schools.

Decline and fall of a state system of boys' and girls' agricultural clubs, J. Main (*School and Soc., 3 (1916), No. 67, pp. 514–520, fig. 1*).—The author describes the system of boys' and girls' agricultural clubs in operation at the Oklahoma Agricultural and Mechanical College until the fall of 1914, when the Federal system of clubs was substituted for it. He considers the following peculiarities of this state system as contributing to the decline of the club movement: The unfortunate conception of a "club"; overemphasis of prizes to the exclusion of the educational purposes of the organization; disproportionate prizes or a lack of careful supervision in the application of prizes to avoid overemphasizing some things to the exclusion of others equally important; misfit projects and failure to induce local initiative; propriety of scholarships based on projects; inflation of membership; and political connections. The author finds that the system "as a propaganda did a great deal of good to the college and to its membership by making a place for the club idea, as well as in the lessons to be learned from its shortcomings. But the time always comes to a propaganda when it should give place to more conservative and constructive organization. And that time has arrived for all phases of agricultural education."

School gardening a fundamental factor in education, L. H. Harvey (*Nature-Study Rev., 12 (1916), No. 4, pp. 178–183*).—The author, in analyzing the influences of soil contact as it reacts upon the child, holds that garden work is auto-educative to an extent unequaled by any influence which the graded school can bring to bear upon the child; creates producers, instills civic interest, and engenders the esthetic; develops the faculty of cooperation; fosters adaptability, resourcefulness, and self-reliance; and forms the missing link between the home and the school.

Report on the work of the Direction of Agriculture for 1913 (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag Dir. Landb., 1913, pp. VII+71*).—This is a report on the activities of the Direction of Agriculture of the Netherlands in agricultural instruction, investigation, and extension work in 1913.

Illustrated lecture on the production of alfalfa east of the ninety-fifth meridian, H. L. WESTOVER and H. B. HENDRICK (*U. S. Dept. Agr., States Relations Service Syllabus 20 (1916), pp. 17*).—This lecture, which is intended for farmers' institute and other extension lecturers, gives a brief history and description of alfalfa, directions for growing and harvesting, and a discussion of its feeding value. The syllabus is illustrated with 51 lantern slides.

Illustrated lecture on corn production, C. P. HARTLEY and H. B. HENDRICK (*U. S. Dept. Agr., States Relations Service Syllabus 21 (1916), pp. 24*).—The authors briefly discuss the corn yield of the United States and give instructions for growing, harvesting, and storing corn. The syllabus is designed to aid farmers' institute and other extension lecturers in presenting this subject before popular audiences, and is illustrated by 52 lantern slides.

The North Carolina corn bulletin, E. E. BALCOMB (*N. C. State Supt. Pub. Instr., Teachers' Bul. 24 (1915), pp. 80, figs. 28*).—This publication has been prepared to help teachers of North Carolina in giving instruction on corn to their classes. It treats of the celebration of Corn Day, the importance of corn and its products, the history of the corn plant, corn growing, judging, testing, selection, improvement, and harvesting, and corn pests and diseases, and suggests a field exercise, the systematic preservation of information by means of agricultural booklets, with directions for making them, and industrial work connected with corn, arranged by months.

Illustrated lecture on orchard management, H. M. CONOLLY and E. J. GLASSON (*U. S. Dept. Agr., States Relations Service Syllabus 23 (1916), pp. 15*).—Directions are given for selecting the site for and planting the orchard, soil management, pruning, thinning, rejuvenation, spraying, protection from rodents, injurious insects, and diseases. The syllabus is illustrated by 50 lantern slides, and has been prepared for the use of farmers' institute and other extension lecturers in presenting this subject to popular audiences.

Illustrated lecture on how to make good farm butter, J. H. MCCLAIN (*U. S. Dept. Agr., States Relations Service Syllabus 19 (1916), pp. 10*).—This lecture compares the old and new methods of butter making. The syllabus is illustrated with 51 lantern slides, and has been prepared to aid farmers' institute and other extension lecturers in presenting the subject before popular audiences in the Southern States.

Dairying project, C. A. NORCROSS and V. E. SCOTT (*Agr. Ext. Univ. Nev. Bul. 2 (1916), pp. 20, figs. 11*).—The dairy project work outlined in this bulletin for the members of the boys' and girls' animal husbandry club includes a 4-months' practical course in the study of milk, its composition, care, handling, and sanitation, herd management, feeds and feeding, etc., the use of the Babcock test, and keeping herd records. Members satisfactorily completing the course are awarded a certificate which authorizes them to contract with farmers to test a limited number of dairy cows once a month during one year under the supervision of the State leader in dairying and to charge at the rate of $1 a head therefor.

Illustrated lecture on cattle-tick eradication (*U. S. Dept. Agr., States Relations Service Syllabus 22 (1916), pp. 14*).—This lecture deals with the life history of the cattle tick, the beginning of tick eradication and reasons therefor, cause of the disease, other kinds of ticks, losses occasioned by cattle ticks, methods of eradication, areas freed of ticks, cooperation between the Bureau

of Animal Industry of this Department and state authorities, live stock development following tick eradication, and what this Department will do to assist in eradicating the tick. The syllabus is designed to aid farmers' institute and other extension lecturers and is illustrated with 50 lantern slides.

Manual training for the rural schools, L. M. ROEHL (*Milwaukee, Wis.: Bruce Publishing Co., 1916, pp. 45, figs. 48*).—This text for rural schools consists of a set of farm and farm home woodworking problems. Each problem gives lists of the material and tools required, together with a stock bill and directions for making the article.

Correspondence courses for teachers. Course III, Home economics (*Corresp. Courses Teachers [Iowa Agr. Col.], Agr. Ext. Dept., Course III, Assigns. 1, pp. 28, figs. 5; 2, pp. 30, figs. 2; 3, pp. 26; 4, pp. 31; 5, pp. 27; 6, pp. 32, fig. 1; 7, pp. 35; 8, pp. 29, fig. 1*).—Lessons are outlined for the use of teachers in rural and graded schools on the location, ventilation, and lighting of the home, the disposal of wastes, control of dust, care of milk and butter and other food supplies, dish washing, prevention of contagious diseases, care of the sick, food principles and their uses in the body, composition and uses of various foodstuffs and their value in the diet, together with recipes, preservation of food, hot and cold beverages, home management, personal hygiene, serving meals, and digestion.

Home economics: Its opportunities and obligations, ISABEL BEVIER (*School and Soc., 3 (1916), No. 73, pp. 737–740*).—This article treats of home economics as one of the agencies in the education of women. After briefly indicating the meaning and content of home economics and its possible points of contact with the training of individuals, the author considers the following as the opportunities and obligations: (1) To teach the technique of household processes, to restate what was best in the old forms of family life in new terms; (2) to teach the meaning of economy and the principles which underlie it; (3) to bringing once again into honorable repute the business of housekeeping, to apply it to the usages which obtain in other business enterprises; (4) to supplement the training of the nurse in technique and the diagnosis of the doctor by showing the value of adapting the diet to the needs of the individual; (5) to teach a new definition for art; (6) through the Smith-Lever Act, to better the life in the farm home; and (7) to teach the unity of life and knowledge through schools and clubs and homes so that all will cooperate to the common welfare.

The interdependence of forest conservation and forestry education, J. W. TOUMEY (*Science, n. ser., 44 (1916), No. 1132, pp. 327–337*).—The author discusses the progress made in this country (1) toward forest conservation, (2) in the educational propaganda, begun more than a century ago, which made possible the public ownership of approximately one-fifth of the total area of forests in the United States, and (3) in the technical training in the science and art of forestry, which had its beginnings within the past two decades.

It is shown that in a space of 15 years, or prior to December, 1915, 1,185 men had been granted degrees in forestry in the 22 institutions in the United States offering technical courses in forestry leading to a degree. About one-half of the degrees have been undergraduate degrees given for four years of collegiate work. Advanced degrees in forestry are offered by 10 institutions. In April, 1915, out of 1,037 men who had then received degrees, 803 were reported as actually engaged in forestry. In June, 1915, these institutions offered degrees in forestry to 147 men.

Attention is called to the overstimulation of professional training and the underdevelopment of vocational instruction, even though in forestry scores of foremen, guards, and rangers are necessary for every professionally trained

forester, and to the rapidly decreasing demand in the past four years for professionally trained men. While more than 50 institutions have within the past 15 years developed more or less work in forestry education below the grade of full professional training, it is stated that it has largely been without definite aim and poorly suited to the real needs of the country, very little of it even approaching the requirements of the ideal vocational school. In order to best conserve the purposes of forestry education in the United States the author thinks at least two-thirds of the money now expended on professional training could be better spent in the instruction of the public through the organization of institutes, field demonstrations, and similar methods that have been found so effective in agriculture, and in the organization of vocational schools for the training of young men in the art of forestry practice. It is his opinion that the progress made in the actual conduct of forestry operations in the woods must center in a large number with some training rather than full professional training, whose knowledge of forestry is chiefly confined to the art of forestry so far as it concerns their own locality, and who do not look for and should not expect a wage beyond which the operations justify.

A bibliography of forestry education is appended.

MISCELLANEOUS.

Thirty-ninth Annual Report of Connecticut State Station, 1915 (*Connecticut State Sta. Rpt. 1915, pt. 6, pp. XVI*).—This contains the organization list, a report of the board of control, and a financial statement for the fiscal year ended September 30, 1915.

Annual Report of Nevada Station, 1915 (*Nevada Sta. Rpt. 1915, pp. 56, figs. 5*).—This contains the organization list, a report of the director on the work of the station, departmental reports, the experimental work in which is for the most part abstracted elsewhere in this issue, and a financial statement for the fiscal year ended June 30, 1915.

Report of the Canada Experimental Farms, 1915 (*Canada Expt. Farms Rpts. 1915, pp. 1229, pls. 97*).—Volume 1 of this report contains the report of the director, including general notes, meteorological data, and synopses of the work of the various divisions, branch farms, stations and substations, and reports of the divisions of chemistry, field husbandry, and animal husbandry. Volume 2 contains reports from the divisions of horticulture, cereals, botany, bees, forage plants, poultry, and tobacco. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Monthly Bulletin of the Ohio Experiment Station (*Mo. Bul. Ohio Sta., 1 (1916), No. 9, pp. 257–288, figs. 19*).—This contains several articles abstracted elsewhere in this issue; Three Important Internal Parasites of Sheep, by D. C. Mote, an abridgment of Bulletin 280 (E. S. R., 33, p. 279); and the following special articles: The use of the Score Card in Potato Judging, by S. N. Green; and Identification of Clover Teaf Tyer, by H. A. Gossard.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta., Mo. Bul., 4 (1916), No. 6, pp. 20, figs. 2*).—This number contains brief articles on the following subjects: Canning Vegetables by the Cold-pack Process, by T. J. Newbill; Strawberries in Western Washington, by J. L. Stahl; Seeding and Management of Grass Land, by E. B. Stookey; and The Shoup Oat Sprouter, by Mr. and Mrs. G. R. Shoup (see p. 75).

A handy field and laboratory binocular magnifier, R. S. Woglum (*Jour. Econ. Ent., 9 (1916), No. 3, pp. 370, 371, fig. 1*).

NOTES.

Florida University and Station.—O. W. Weaver has been appointed agricultural editor.

Indiana Station.—D. F. Mattson has resigned as assistant in creamery inspection to become inspector in market milk work at the University of Wisconsin, vice A. C. Baer, whose resignation has been previously noted.

Maine Station.—William R. Rich and Walter W. Webber, assistant chemists, have resigned to accept commercial positions. Elmer R. Tobey, formerly assistant chemist, has been reappointed to that position.

Maryland College.—Plans have been approved by the building committee for the new agricultural building, for which $175,000 was appropriated by the last legislature. A three-story and basement structure, with a front wing 200 by 68 feet, connected by an enclosed bridge with an auditorium seating about 1,000 people, and this in turn connected with a rear wing of the same dimensions as the front, is contemplated. The front wing is to be used for offices and classrooms and the rear wing for stock judging and exhibitions and experimental work. It is hoped that the structure will be ready for use next fall.

Evening courses in various branches of agriculture are being offered, including special work in bee keeping, poultry raising, and fruit growing for suburban residents of Washington, D. C. College credit is to be given for these courses so far as practicable, with a system of certificates showing all work completed.

Massachusetts College and Station.—Rudolph W. Ruprecht, Ph. D., resigned as assistant chemist in the station December 1, 1916, to engage in commercial work. Arnold P. Sturtevant, Ph. D., assistant in veterinary science, resigned on the same date to accept a position in the U. S. Department of Agriculture, and has been succeeded by Dr. A. C. Edwards, whose time will be divided equally between the college and station. John B. Smith has been appointed assistant chemist in the section of foods and feeding, beginning October 1, 1916, and Miss Grace B. Nutting, curator in the department of botany, beginning January 1.

Minnesota University.—Dr. George E. Vincent has resigned as president to become head of the Rockefeller Foundation, beginning May 15.

Harvey M. Bush, farmers' club specialist in the extension department, died December 15, 1916, at the age of 33 years.

The school of agriculture at Crookston is offering two scholarships at $100 each and 10 at $125 each, four of the latter scholarships being awarded as prizes to prospective students in contests in corn and potato growing, bread making, and pig raising. A special loan fund for students is also provided by a committee of citizens of Crookston.

Missouri University and Station.—E. R. Spence, extension assistant in veterinary science, has resigned to become superintendent of live-stock experiments at the Texas Station, and has been succeeded by Dr. John S. McDaniel, previously assistant professor of veterinary science in the Michigan College.

Other recent appointments include F. C. Fenton, previously extension assistant in agricultural engineering in the Iowa College, as extension assistant professor of agricultural engineering, and Mark J. Smith, previously assistant animal husbandman in the Kentucky Station, as extension instructor in animal husbandry.

Montana Station.—R. A. Studhalter, research fellow in the Missouri Botanical Garden, has been appointed assistant in botany and bacteriology.

Nebraska University and Station.—H. D. Landis, of Seward, has been elected to the board of regents, succeeding W. G. Whitmore. P. L. Hall has been reelected to the board.

C. B. Lee has resigned as professor of animal husbandry and animal husbandman to accept a commercial position, this taking effect December 1, 1916.

New Hampshire College and Station.—W. L. Doran, graduate assistant in botany at the Massachusetts College, has been appointed instructor of botany and assistant botanist.

New Mexico College and Station.—F. W. Christensen has resigned as nutrition chemist to become professor of animal nutrition at the North Dakota College, and has been succeeded by J. D. Hungerford. C. I. Depuy, of the Forest Service of the U. S. Department of Agriculture, has been appointed extension secretary, vice C. P. Wilson resigned November 15, 1916, to become secretary and editor for the station.

North Carolina College.—The division of home economics reports that 3,731 girls and 2,864 women, engaged in canning work in 44 counties, have filled a total of 680,551 containers at a profit of $88,383.96. Twenty-seven scholarships have also been awarded in schools and colleges and 105 girls are paying their way either wholly or in part through their canning club work. The girls have also been active in making caps and dresses during the winter months and in starting winter gardens, which are a new thing for the South.

Twenty-five dairy schools have recently been held in the western part of North Carolina by members of the college staff and others are being arranged for.

Ohio State University.—P. B. Potter has been appointed instructor in agricultural engineering.

Oregon College and Station.—At the Third Annual Horticultural Show, held November 3 and 4, 1916, a 40 by 60 foot floor map of the United States, laid in green moss with the State boundaries marked in gray moss, was used to give a graphic representation of the pomological products of each State. Apples from 30 States were exhibited in variety groups, showing variations due to the soil and climatic conditions where grown. Competitive exhibits of fruits, grown by graduates of the college and by students now in attendance, were also shown. In the vegetable garden section, broccoli, Oregon's new $25,000 winter crop, was given special prominence, while chrysanthemums formed the main feature of the floral display. The entire show was staged in a replica of the Tudor Gardens of England.

The annual winter short course began January 8 and closed February 2. One of its unique features was an apple packing school to instruct orchardists who will make their first commercial shipments of apples this year. A considerable number of new commercial orchards will come into bearing this season for which no expert packing help may be available.

The First Annual Northwest Grain Convention was held at the college January 3 to 5 in connection with the farmers' and homemakers' week. The bulk handling of grain was the special subject considered, farmers, dealers, shippers, and transportation men participating in the discussion.

A farm engine exhibit and demonstration was held by the farm mechanics department during the first two weeks of January.

A. L. Lovett, acting entomologist and associate professor of entomology, has been appointed entomologist with the rank of professor. G. R. Hyslop has been appointed collaborator in charge of the seed-testing laboratory, conducted jointly by the college and the U. S. Department of Agriculture, with Miss Norma Waddell as the official seed tester.

Pennsylvania College and Station.—I. D. Wilson, D. V. M., has been appointed instructor and assistant in animal husbandry, G. A. Meckstroth assistant in botany, L. P. McCann assistant in animal husbandry, and A. L. Beam instructor and assistant in dairy husbandry.

Pennsylvania Institute of Animal Nutrition.—W. H. Matthews, a 1916 graduate in agriculture of the college, has been appointed assistant.

Porto Rico College.—A revised course of study has been authorized by the chancellor of the university. This consists of a four years' subcollegiate course which provides sufficient technical work so that the collegiate work can be completed in three years. It is thus modeled on the general plan of polytechnic institutes that admit students to the sophomore classes of colleges. It is stated that the full course now ranks with that offered by the stronger American agricultural colleges. The enrollment has reached 225, a decided increase over previous years. Special opportunity is being offered students desiring to prepare themselves for work in tropical countries. The classes are conducted in English, but Spanish is usually quickly acquired as it is spoken by the students. Short courses are also being offered to rural teachers.

A new science building of 10 rooms has been completed and occupied. The new dairy laboratory is also completed.

Recent appointments include H. T. Cowles in horticulture, Dr. Jaime Bagué in animal husbandry, and Dr. R. I. Garton in zoology and entomology.

Utah College and Station.—Dr. E. G. Titus, professor of entomology and entomologist, has resigned to accept a position with the U. S. Department of Agriculture in connection with its sugar-beet investigations in Utah and Idaho.

National Congress of Horticulture.—Following a meeting called by the American Pomological Society, a National Congress of Horticulture was organized at Washington, D. C., in November, 1916, to serve as a central clearing house of horticultural interests. Active membership is to consist of delegates appointed by affiliated horticultural organizations on the basis of membership, and it is hoped thus to enroll representatives of from 50,000 to 60,000 members.

E. R. Lake, of the Bureau of Plant Industry of this Department, has been chosen secretary of the new organization.

Necrology.—J. Wrightson, president of the college of agriculture at Downton from 1880 to 1906, honorary professor of agriculture in the Royal Agricultural College at Cirencester, and professor of agriculture and agricultural chemistry at the Royal College of Science at South Kensington from 1882 to 1898, died November 30, 1916.

Captain R. W. Nichols, assistant in milling and baking at the central station of the Canadian Experimental Farms, was killed in the European War October 23, 1916, at the age of 31 years.

George G. White, professor of farm management and rural economics at the Manitoba Agricultural College, was killed October 10, 1916, while operating a farm tractor.

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A. C. TRUE, DIRECTOR

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1917

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The need of special training for the men who conduct the experimental and research work of the experiment stations has been felt almost from the first. The early work of the stations was relatively simple and fewer lines of investigation were maintained. The agricultural colleges were looked to mainly to supply the necessary men and the requisite training. It soon became apparent, however, that the courses of study in agricultural colleges did not at that time supply the whole need. These courses were necessarily quite general and were intended more especially to make farmers rather than investigators. They supplied a general knowledge of the theory and principles but rarely gave opportunity for contact or experience with research.

From the first the stations themselves have been a large factor in training men for the special work of agricultural investigation. They have furnished not only a stimulus to special preparation, but an opportunity for acquiring experience through a sort of apprenticeship. To some extent they have trained their own men. But as time has passed this too has been found inadequate to the needs in many lines. The work of the stations has become more technical and serious, and they need for it men already well equipped and with a broad outlook.

The making of an effective research man or a constructive and original experimenter is a longer and far more difficult process than making a bachelor of arts or of science. The requirements start with the man himself, his temperament, his capacity for right thinking, his ability to receive the impression of high ideals and acquire lofty standards, and his love of truth. There must be a foundation to build upon. If a sifting process could start at this point it would save some time, expense, and disappointment, but such a sifting is only partially possible; largely the result must be worked out by experience.

Whether a man is preparing for an experimental or research career he needs some hard, rigid training that will bring him up against the real meaning of science. He must learn the elements that go to make up a fact, and how to attest its value. He must get not only a broad

foundation of information but he must acquire an attitude and a method. This is often much harder than learning facts and principles, and it is where some men prove lacking.

The graduate student often feels that he needs especially a larger fund of information to make him efficient and resourceful, and sets out to get knowledge. He needs not only this but to get understanding, to develop an inquiring attitude, a vision, a discriminating criticism. He needs to come directly and intimately into contact with research in its higher restricted sense, as an active participant. This teaches him its real responsibilities and its exact nature. For this purpose graduate study in some of the older exact sciences is especially advantageous, because the methods are better worked out and the requirements usually more severe. Graduate work in some of the divisions of agriculture may not necessarily convey a deep impression of the spirit and feeling of science. Whether it does or not depends somewhat upon the teacher. The tasks and problems set are often comparatively simple in their scientific aspects, although they may be laborious and difficult in other respects.

The means of training and of securing competent persons for the work of the stations continues to be a live question. It was one of the topics before the last convention of the Association of American Agricultural Colleges and Experiment Stations, and was discussed in two important papers in a joint meeting of the sections of college work and experiment station work. The discussion related specifically to the encouragement of advanced training by offering employment to a limited number of graduate students as part-time research assistants in the station. Such an arrangement has been put into effect at a number of the stations, and especially at the New Jersey Station it has constituted a definite policy and a means of providing assistance.

In discussing this plan from the standpoint of advantage to the station, Dr. J. G. Lipman described its operation at his institution. The station was led into the plan partly from considerations of economy, feeling that it offered a means of securing cheap assistance without lessening the effectiveness and value of the research, and at the same time would stimulate advanced study.

The present tendency to organize station work on the project basis has been found to favor the use of graduate students as research assistants. Thus research problems of considerable magnitude may be divided so as to assign different parts to assistants working under close supervision; and "an experienced investigator may so arrange his research problems as to permit the utilization of the services of beginners in research, provided they possess the right temperament and training." While it is not the practice to place

untrained graduate assistants directly in charge of important phases, it is found that they may be satisfactorily assigned to many duties in connection with such projects, often of a more or less routine nature at the outset, and as they develop in ability and initiative more responsible and technical parts of the work may be turned over to them. Ultimately a phase of a project may serve as the subject of a master's or doctor's thesis.

Dr. Lipman recognized that the system might break down if the research problem were not carefully analyzed and so subdivided as to make portions of it safe to entrust to research students. Success also depends on securing young men who possess not alone adequate technical training but temperamental and other qualities fundamental to the making of good investigators.

The New Jersey Station at present regularly employs nine research assistants on a half-time basis, the remainder of the time being devoted to study. Naturally a longer time is required to secure a degree than if full time were devoted to study, but the salary paid such assistants is found to offset the time element with a considerable number of men. The problems assigned these assistants by the station are as far as possible correlated with their major studies as graduate students in the college.

Since the adoption of this plan it is felt at the station that its research work has improved in quality and to some extent increased in amount, and at the same time there has been a gain to a number of young men who are preparing themselves for service in agricultural investigation.

An interesting turn to the discussion was given by Dr. L. R. Jones of Wisconsin, who considered the matter from the standpoint of the teacher and the student. He held the two most important functions of the teacher in relation to graduate students to be "aiding men wisely to choose their own profession, and properly placing within reach of the men the means of their education." He felt there were certain dangers in the research fellowship plan, owing to the effect which financial help might have on the student in reaching a choice.

"We may all agree that any such help that makes possible the high training of our best types of research students is desirable. But do we not need to recognize that in this or any other financial offering which influences immature students to start upon research as a profession lurks the danger of attracting the weaker more than the stronger?" While zealously searching for the right man, therefore, equal care should be exercised "not to tempt or bribe the unfit."

Considering further the best interests of the student, Dr. Jones pointed to the advantage of a change of location from his Alma Mater to another institution for his graduate study, especially after

the first year or so of advanced work. Among the benefits of such a migration were mentioned "a completely changed environment, a fresh library, a different laboratory, a new set of scientific associations, another departmental leader and adviser."

Professor Jones recognized the very marked advance in facilities for graduate study at many of our American institutions, and expressed the belief that "hereafter no American student, at least in the sciences fundamental to agriculture, need leave America in order to find the best in graduate opportunity as represented in library, laboratory, or personal leadership." But he referred to a certain provincialism in this country as compared with European institutions, which tends to accentuate the advantage of migration to another institution. Loyalty to Alma Mater is often responsible for a feeling that it affords advantages at least equal if not superior to those to be had elsewhere; and this, together with the rapid growth of the agricultural colleges, has frequently resulted in a kind of "inbreeding" which is not advantageous to a broad outlook and proper perspective.

These things have affected the easy and natural migration of graduate students, which the aid of teachers is needed to overcome. Dr. Jones felt that "practically every candidate for the doctor's degree who is being held by an institution for three or more years of resident work should be expected to spend at least one semester at another institution, and perhaps two would be better." Until such interchange becomes as much a custom here as it is among European students, he urged that teachers and administrative officers should stimulate it by advice and requirement.

While these views are not necessarily in conflict with the plan of employing research assistants in the station with opportunity for graduate study, it was suggested that in practice the best local men would often be selected for such employment, which in the end would be disadvantageous to the student if continued throughout the period of graduate study. "Our agricultural professions need recruits trained in the broadest and best way, and such a method fails to meet these standards."

The advantages from such intermigration of research students between different institutions are manifest—the coming into a new environment with somewhat different standards or points of view, a new laboratory routine or method of presentation, an association with men from other institutions in different parts of the country, all have a tendency to stimulate, to arouse, to develop, and to liberalize the student in his attitude toward science. So far from being an evidence of lack of application and diletantism, it is an evidence of a desire to get not only the best that is to be had in science

but a broader understanding of teaching and research and a wider horizon.

Perhaps it may transpire that the plan of employing graduate students as part-time research assistants may tend to promote migration rather than otherwise, by affording the means which will enable it. The added expense of going to another institution might often deter students of limited means from following that course, and result either in their remaining at their home college or having to be content with a shorter period of study. With proper helpful guidance on the part of the teacher, therefore, the advantage which Dr. Lipman claims, to the student as well as to the institution, may be realized and the dangers which Dr. Jones has so pertinently pointed out be avoided.

Evidently the stations can not depend too extensively on assistants of this type, and provision will still need to be made which will meet the special requirements of the work they have in hand. The graduate students will therefore in a measure supplement the regular forces of the stations, providing relatively cheap assistance in the technical features.

Many of the stations have, of late especially, felt the necessity of giving attention to simulating advanced study on the part of their assistants and making some form of provision or requirement for it. It has become a well established practice at several stations to require young men entering the work to take advanced study from time to time as a prerequisite to advancement. Others, while exacting this requirement, have gone so far as to prohibit the taking up of graduate work at the local institution while retaining their position in the station. This may be due to a disinclination to combine station service and graduate study, or to a belief that the student should go away for such study.

The plan has worked out somewhat differently at different stations, but in general the present tendency is to recognize the necessity for occasional furlough to take advanced work, in order that the enthusiasm and mental alertness of the investigator may not suffer from monotony and a stereotyped activity.

Most of the endowed universities and other institutions of higher learning now give credit for research work done on recognized projects at the experiment stations, some requiring only a single year's residence at the institution for a doctor's degree. Many of the younger station men are availing themselves of this opportunity, and the number is increasing from year to year. The plan has been found to work to the mutual advantage of both the station and the research workers. Several of the colleges have an arrangement for sabbatical leave, with part pay, for purposes of study. This is not

always recognized as a right but rather as a privilege, to be granted to workers in recognition of special merit or accomplishment.

An interesting modification of this plan has been recently put into operation at the Minnesota Station. It is announced that hereafter station workers will be on the same basis as teachers in the college with respect to vacation. Of the three months' vacation thus provided, it is required that one month be taken for rest and recuperation, while in the other two months the station men are expected to go to other institutions for advanced lectures, to observe new laboratory methods and practices, and in general to gain information and suggestion which will bear particularly on their own special lines of work. This liberal plan gives all men on the station staff, without regard to age, an annual opportunity of renewing their enthusiasm and acquiring the inspiration of new ideas which come with sojourn at another institution and intimate association with other workers.

At one of the New York meetings during the holidays reference was made to the relatively small part which physics has yet played in the study of problems in agricultural science. The laws of physics are of course applied by agricultural investigators as all science may be employed so far as it comes within the range of the investigator. In this way physics is borrowed to some extent by the workers in soils, in biology, and in other branches of science, who make limited excursions into the domain of that science for such aid and suggestion as they may be able to appropriate. But consciously physics as a science has done far less through its exponents to serve farming or influence investigation in it than many other branches of science.

Physicists have been busily engaged in working out the laws and problems of dead matter, the physical forces, the heavenly bodies, etc., but it is rare to find one who has brought his science to bear on the activities of the living organism. His special point of view and his intimate knowledge of the laws of matter have not been directed toward the problems met in agricultural science. There has been little attempt to relate research in physics to agricultural problems, and almost as little to employ it in agricultural inquiry, which has evidently escaped the physicist's notice.

Rarely also has the embryo agricultural investigator been led to select physics as a subject for graduate study, or one in which to perfect himself as an aid in his search for causes and explanations. This is probably due to the fact that the subject has not been opened up in its full agricultural importance, and physicists absorbed in other lines of interest have given little attention to elaborating and pointing out its fundamental bearing at many points. The field of the physicist with a distinct agricultural outlook and interest remains, therefore, an undeveloped one.

Apropos of these thoughts it is interesting to mention an instructive lecture on The Living Plant as a Physical System, recently delivered by Dr. Lyman J. Briggs of this Department. This was a remarkable address on account of the novelty of the subject and the new outlook it presented. It was highly suggestive of the advantage of the physicist's viewpoint in approaching and in attempting to explain phenomena in plant life connected with its physiological activity and its relations to its environment.

Dr. Briggs dealt especially with such functions as plant transpiration, efficiency in the use of water by different groups of plants, drought resistance, the rise of water in the plant, the assimilation of carbon dioxid, and other processes of growth. He illustrated some of these phenomena by experiments with physical apparatus, notably the theory upon which the rise of sap in trees depends, the action of the mechanism to prevent interference through air bubbles, etc. He discussed the mechanics of these processes, and the physical measurement of the plant's response to differences in environment. He showed how in many cases the vital activities of the plant follow quite closely established laws and principles in physics, and made it clear in how large degree the explanation of manifestations which are observed in practice and in scientific inquiry may with advantage be sought through that science.

Already the quantitative methods of physics and physical chemistry have begun to invade biological research, as Dr. Loeb recently explained. This marks a step in advance for it shows that zoologists and botanists have come to "grasp the fact that the progress of science depends upon the invention or application of such methods." So many of the processes of living as well as of dead matter rest upon physical laws and principles that there is reason to believe a much larger field is open to physics in agricultural investigation than is at present occupied. The employment of the science by specialists in it who are acquainted with agriculture and its problems would contribute a viewpoint and a method highly important and helpful. An intimate knowledge of it may supply a very material element of strength in the agricultural investigator.

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RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The physical properties of colloidal solutions, E. F. Burton (*London and New York: Longmans, Green & Co., 1916, pp. VII+200, figs. 18*).—This volume discusses the physics of colloidal solutions under the following topics: Preparation and classification of colloidal solutions; the ultramicroscope; the Brownian movement; the optical properties of colloidal solutions; measurement of the sizes of ultramicroscopic particles; motion of colloidal particles in an electric field, cataphoresis; the coagulation of colloids; theory of the stability of colloids; and practical applications of the study of colloidal solutions. A bibliography of the literature cited is appended to each chapter.

The influence of ethyl alcohol and glycerol upon the rate of solution of casein by sodium hydroxid, T. B. Robertson and K. Miyake (*Jour. Biol. Chem., 26 (1916), No. 1, pp. 129–142, figs. 4*).—The work reported has shown that both alcohol and glycerol retard the penetration of casein particles by 16/1,000-normal sodium hydroxid. The penetration formula (E. S. R., 35, p. 712) expresses the relationship between the quantity of casein dissolved and the time of stirring in all the glycerol-water mixtures studied, and in alcohol-water mixtures containing less than 4.5 or more than 7 molecules of alcohol.

Further considerations on the effect of the concentration of alcohol and glycerol are also set forth.

A comparative study of the behavior of purified proteins towards proteolytic enzyms, E. M. Frankel (*Jour. Biol. Chem., 26 (1916), No. 1, pp. 31–59, figs. 4*).—The experiments reported demonstrate that in pepsin-hydrochloric-acid digestion pepsin is the effective agent, since hydrochloric acid, in the concentrations ordinarily employed, has very little proteolytic effect.

It is concluded that comparable results in proteolysis studies are to be obtained only when the substrates are in solution; otherwise deviations of from 10 to 15 per cent may be encountered in duplicate experiments. A parallelism in the cleavage curves of 13 proteins examined was observed, the cleavage being calculated as the ratio of amino nitrogen liberated at any one time to that obtained on total hydrolysis of the protein with strong acid. Pepsin-hydrochloric acid was found to liberate about 20 per cent of the total amino nitrogen of a protein in less than 100 hours. Trypsin acting on such partially digested proteins effects a cleavage of about 70 per cent, while its action on native proteins causes a cleavage of only about 50 per cent of the peptid linkages. Erepsin following the action of pepsin was found to be a very effective agent in causing the disruption of the protein molecule, about 85 per cent of the protein being cleaved in the experiments reported. By the successive action of pepsin, trypsin, and erepsin from about 85 to 90 per cent of the total amino nitrogen was found to be liberated in the protein studied.

The origin of the humin formed by the acid hydrolysis of proteins.—II, Hydrolysis in the presence of carbohydrates and of aldehydes, R. A. Gortner (*Jour. Biol. Chem., 26 (1916), No. 1, pp. 177–204*).—Continuing the work

of Gortner and Blish, previously noted (E. S. R., 35, p. 311), the author at the Minnesota Experiment Station has found that the amount of ammonia nitrogen in a protein hydrolyzate is not significantly altered when hydrolysis is carried out in the presence of a quantity of carbohydrate equal to three times the weight of the protein material.

If the weight of carbohydrate material present greatly exceeds the amount of protein an accurate nitrogen distribution by Van Slyke's method can not be obtained. The amount of humin nitrogen is greatly increased by the presence of carbohydrate, probably because of both chemical and physical causes. Tryptophan can not be accurately estimated by hydrolyzing proteins in the presence of carbohydrates. When fibrin is hydrolyzed in the presence of furfural the humin nitrogen is greatly increased. This increase is deemed due not only to a chemical reaction in which certain amino acids combined with furfural, but also to adsorption or occlusion of other amino-acid nitrogen by the humin. When furfural is boiled with strong hydrochloric acid approximately 75 per cent by weight is converted into a black insoluble mass. It is suggested that perhaps the humin, "formed from carbohydrates by boiling with hydrochloric acid, is actually formed from furfural, which is in turn formed from the corbohydrate."

When fibrin is hydrolyzed in the presence of benzaldehyde the humin nitrogen rises rapidly to a maximum of approximately double the amount produced in an ordinary hydrolysis. "The reaction here appears to be wholly chemical. The ammonia nitrogen is not significantly altered, although there is evidence that some deamination takes place." When fibrin is hydrolyzed in the presence of formaldehyde an initial gain of humin when small amounts of formaldehyde are used is observed, but a large loss when greater quantities of the aldehyde are present.

"Both tryptophan and tyrosin yield a very considerable proportion of 'acid-insoluble' humin nitrogen when boiled with hydrochloric acid in the presence of benzaldehyde. When tryptophan is boiled with formaldehyde, in the presence of hydrochloric acid, a very considerable part of the nitrogen is retained in the acid-insoluble humin. This is in decided contrast to the behavior of tryosin, where no acid-insoluble humin is formed, but where a greater or less percentage of the nitrogen is retained in the 'acid-soluble' humin, the amount retained depending upon the quantity of formaldehyde present. Some deamination occurs in both amino acids, when heated with either aldehyde, in the presence of hydrochloric acid."

It is indicated that "when nitrogenous compounds other than proteins are present in a hydrolyzate no reliance can be placed upon the figures obtained in any of the fractions, as representing actual amino acids. Such data should not be compared with those obtained by the analysis of pure proteins."

Formation of hematoporphyrin in ox muscle during autolysis, R. Hoagland (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 1, pp. 41–45*).—Experimental data obtained in the course of a study of autolysis in ox muscles demonstrate that the striated muscular tissue of the ox contains enzyms which, under anaerobic conditions, readily reduce oxyhemoglobin to hematoporphyrin. The probability that hematoporphyrin may be a regular intermediate product in the transformation of hemoglobin into bile pigments is indicated.

The autolyses studied covered periods ranging from 7 to 220 days.

Biochemical reaction of rancid fats, J. Vintilescu and A. Popescu (*Bul. Chim. [Bucharest], 17 (1915), pp. 145–150; abs. in Chem. Zentbl., 1916, I, No. 5, p. 235*).—Fats which have become rancid and have been exposed to the air absorb oxygen, which can be liberated through peroxidase. The oxygen ab-

sorbed is detected by the well-known guaiac reaction, and the degree of rancidity thus determined. The following test is described:

To about 10 gm. of the sample in a test tube (solid samples being slightly heated to melt them) from 4 to 5 drops of a 5 per cent aqueous blood or hemoglobin solution, 10 drops of freshly prepared tincture of guaiac, and about 10 cc. of water are added and the mixture thoroughly shaken for a few minutes. Rancid fats give a blue color reaction with this test, the strength of which increases with the degree of rancidity. A more decided reaction is obtained if, after shaking the mixture, an equal volume of 96 per cent alcohol is added.

The guaiac tincture is made by dissolving 5 gm. of gum guaiac in 100 cc. of 70 per cent hot alcohol. The hemoglobin solution is made by dissolving 3 gm. of the solid in 100 cc. of water, and, after thorough agitation, letting the solution stand exposed to the air in a wide-mouthed flask.

The free fatty acids present in the rancid fat on heating to 120° C. do not influence the reaction, while previous heating to 200° hinders the reaction.

On the localization of acids and sugars in fleshy fruits, E. Demoussy (*Compt. Rend. Acad. Sci.* [*Paris*], *161* (*1915*), *No. 15, pp. 443–445*).—Analytical data as to the juices of purple plums, under- and overripe greengages, apricots, under- and overripe peaches, under- and overripe grapes, strawberries, melons, cherries, and tomatoes are submitted. The juices were obtained by subjecting the fruits to increasing pressure. The data include the number of grams of acid (as malic) and reducing and nonreducing sugars per 100 cc. of juice.

From the data a considerable variation in the acidity of the various fruits was observed. The variations in the sugar content were, however, relatively less.

It is deemed probable that the cells which offer the least mechanical resistance and are the most permeable do not have the same composition as those which furnish the sugars. The difference in their physical structure, probably a variation in the thickness of their walls, is accompanied by a difference in the chemical composition of their contents. There is localization, but it is not the same for all the fruits. Sometimes the most resistant cells contain the least amount of acid and reducing sugars and are rich in saccharose. Sometimes the reverse is true. The composition of the fruit thus varies in different parts in spite of its apparent homogeneity and uniform distribution of water. The semipermeability of the protoplasm prevents the diffusion of soluble material.

This localization of soluble material explains the peculiar fact observed in certain fruits, especially plums and apricots, of an increased acidity in the cooked fruit. By crushing the fruit cold, as acid a juice is obtained as by cooking. It is thought that this increased acidity can not be attributed to any diastatic action, fermentation, or oxidation, but to a dissociation of those cells in which the acid is localized.

Studies in the chemistry and physiology of the leaves of the betel vine (Piper betle) and of the commercial bleaching of betel-vine leaves, II, H. H. Mann and V. G. Patwardhan (*Mem. Dept. Agr. India, Chem. Ser., 4* (*1916*), *No. 7, pp. 281–322*).—Continuing the work previously noted (E. S. R., 31, p. 108), the authors report and discuss analytical data on the moisture, reducing and nonreducing sugars, starch, tannin, ether extract and essential oil, nitrate, and acid content of leaves picked in the morning, at noon, and at night; the varieties of betel-vine leaves, their qualities, and the essential oil in them; and the chemistry of the essential oil of the leaves. The commercial bleaching of the betel-vine leaf is also discussed in some detail.

The use of the centrifuge in analytical chemistry, O. Nolte (*Landw. Vers. Stat., 87 (1915), No. 6, pp. 449–457, pl. 1*).—The use of the centrifuge for separating precipitates in the determination of sodium, potassium, calcium, and phosphorus is discussed and the procedures used are described. The ease of manipulation and the economy of time are indicated as making its use of practical importance.

Note on the applicability of the paper pulp filter to the separation of solids from liquids, S. L. Jodidi (*Jour. Franklin Inst., 182 (1916), No. 1, pp. 61–67; Chem. Engin. and Manfr., 24 (1916), No. 2, pp. 79–81*).—This is a short review of the material previously noted (E. S. R., 34, p. 712; 35, pp. 204, 314).

"Plate" forms of ultrafiltration apparatus, G. S. Walpole (*Biochem. Jour., 10 (1916), No. 2, pp. 254–262, figs. 3*).—The construction and use of two patterns of an ultrafiltration apparatus, using the collodion film as previously noted (E. S. R., 35, p. 612), is described in detail.

A note on the sulphone-phthaleins as indicators for the colorimetric determination of hydrogen-ion concentration, H. A. Lubs and W. M. Clark (*Jour. Wash. Acad. Sci., 6 (1916), No. 14, pp. 481–483*).—This article outlines certain modifications in the methods of preparation of a number of sulphone-phthaleins which were previously described by the authors.[1] The color changes and the approximate ranges of the various sulphone-phthaleins are given in tabular form.

The colorimetric determination of the hydrogen-ion concentration of bacteriological culture media, W. M. Clark and H. A. Lubs (*Jour. Wash. Acad. Sci., 6 (1916), No. 14, pp. 483–489*).—This is a short review of the results of the work previously reported by the authors (E. S. R., 34, pp. 136, 804; 35, p. 801).

The determination of potassium in potassium salts by the perchlorate method, G. Hager and J. Kern (*Landw. Vers. Stat., 87 (1915), No. 4–5, pp. 365–380*).—From an investigation of the method, using pure potassium salts, the authors found that the solubility of the potassium perchlorate in alcohol-containing perchloric acid increases with decreasing strength of the acid in the alcohol. With an increased amount of perchloric acid the solubility markedly decreases. The presence of contaminating salts has the same influence on the solubility. The smaller the amount of contaminating salts the more necessary does the use of alcohol of not less than 96 per cent by volume strength become. Potassium salts which contain considerable amounts of sulphate always yield low results, as the precipitated barium sulphate carries down potassium salts. This error is not only inherent in the perchlorate method but in any procedure in which the sulphates are precipitated by barium chlorid.

The estimation of potassium in presence of other substances, A. H. Bennett (*Analyst, 41 (1916), No. 483, pp. 165–168*).—The author describes a procedure in which the potassium is first precipitated as potassium cobaltinitrite, the precipitate dissolved in a small amount of hot dilute hydrochloric acid, filtered into an evaporating dish and evaporated to dryness, the residue dissolved in hot water, and the potassium then precipitated as perchlorate with perchloric acid.

The method is deemed applicable for the estimation of potassium in wine lees, argols, and tartars, and in liquors of tartaric acid works, where it occurs in the presence of free tartaric acid, sulphuric acid, phosphoric acid, iron, aluminum, and organic matter. When the solution contains rather large amounts of iron and aluminum phosphates they will be precipitated with the

[1] Jour. Wash. Acad. Sci., 5 (1915), No. 18, pp. 609–617.

cobaltinitrite and so interfere with the results. This can be avoided, however, by the addition of sodium citrate, which will keep the phosphates in solution during the cobaltinitrite precipitation.

The estimation of calcium, E. CAHEN and W. H. HURTLEY (*Biochem. Jour., 10 (1916), No. 2, pp. 308–312*).—The residue after the destruction of the organic matter in certain biological materials was found to be completely soluble in sulphuric acid only after prolonged heating. By using phosphoric acid the authors succeeded in effecting complete solution after only a few minutes of heating. The method is described as follows:

The organ or tissue is dried at 100° C. and incinerated in the usual way. Liquid samples are first evaporated on the water bath, dried at 120°, and then incinerated as usual. To the residue 20 cc. of phosphoric acid of specific gravity 1.2 (one volume sirupy phosphoric acid to three volumes water) are added if much calcium is present; if only a little is present 10 cc. or even less is used. On warming the calcium dissolves completely. This liquid is diluted with 50 or 100 cc. of water, according to the amount of calcium present, and the calcium then precipitated by a solution of oxalic acid of proper strength, about five times the theoretical amount of acid being added. Precipitation is rapid and the precipitate is crystalline, but a little calcium remains in solution. To effect complete precipitation ammonia equal in strength and volume to the oxalic acid used is added. If magnesium is present the ammonia must be added slowly and with shaking. The precipitated solution is allowed to stand for one hour, after which it filters quickly and perfectly clear. The calcium is then determined either by a slightly modified volumetric procedure, or by the usual gravimetric procedure.

Comparative experimental data indicate the accuracy of the procedure.

A new color reaction for "oxycholesterol," MARY C. ROSENHEIM (*Biochem. Jour., 10 (1916), No. 2, pp. 176–182, pl. 1*).—A color reaction of cholesterol with technical dimethyl sulphate is described, the spectrum of which shows two absorption bands. The reaction is not given by pure dimethyl sulphate and is deemed due to the presence of monomethyl sulphate in the technical product. "Oxycholesterol" was found to give a purple color reaction with technical dimethyl sulphate which showed an absorption band in the yellow. A typical green reaction was obtained with oxycholesterol and pure or technical dimethyl sulphate after the addition of ferric chlorid showing a well-defined absorption band in the red.

Note on the detection of crude beet sugar in cane products, H. PELLET (*Bul. Assoc. Chim. Sucr. et Distill., 33 (1916), No. 7–9, pp. 169–171*).—The presence of even small amounts of crude beet sugar in cane products is undesirable on account of the disagreeable taste and odor it imparts to the product. The taste, however, is not always a satisfactory indication of the presence of the beet products. Analytical data of the nitrogenous content of crude cane and beet sugars show a decidedly greater quantity in the beet product. It is indicated that the observations reported may serve as a means of detecting the presence of the crude beet sugar in the cane products.

A simple and rapid method for the estimation of volatile acid in wine, W. V. CRUESS and R. W. BETTOLI (*Off. Rpt. Sess. Internat. Cong. Vit., 1915, pp. 263–267*).—A simple method for the determination of volatile acids in wine, suitable for the ordinary wine maker, is described. It consists essentially of estimating the total acid in the untreated wine, then in the wine after driving off the acetic acid, and thus calculating the volatile acid by difference.

The improved procedure, briefly described, consists of decolorizing about a 75-cc. sample with bone black free from carbonates. The completely decolorized wine is then filtered and a 20-cc. sample titrated with tenth-normal alkali

(*a*), using phenolphthalein as an indicator. Another 20-cc. portion of the decolorized wine is then mixed with approximately 2 gm. of sodium chlorid in a 200-cc. Erlenmeyer flask, and the liquid is rapidly evaporated until a copious separation of sodium chlorid takes place and the wine begins to spatter. Twenty cc. of distilled water is now added and the evaporation repeated until sodium chlorid again separates. The liquid is diluted with distilled water and then titrated with tenth-normal alkali (*b*), using phenolphthalein as indicator. The amount of volatile acid in grams per 100 cc. is calculated from the formula $(a-b)\times 0.03$. The use of the factor 0.03 is described in detail. Comparative analytical data submitted indicate the accuracy of the method.

The effect of the number of evaporations and of the sodium chlorid concentration is also discussed.

The composition of some lime-sulphur sprays made according to recognized formulas, A. A. RAMSAY (*Jour. and Proc. Roy. Soc. N. S. Wales, 48 (1914), pt. 2, pp. 242–252*).—This article reports analytical data of a number of lime-sulphur solutions prepared according to various formulas. From these data certain deductions as to the proper method of preparation of the solutions for use under various conditions are indicated.

Canning and preserving with 4-H recipes, JANE S. MCKIMMON (*N. C. Agr. Ext. Serv. Circ. 11 (1916), pp. 3–38, figs. 9*).—This circular contains the regulations and standards to which members of the North Carolina canning clubs are expected to conform. Some things to be observed when canning, instructions to agents, and canning directions, etc., are included.

How can vegetables be best conserved? THEKLA FRIEDLAENDER AND ELISABETH DAMMER (*Zent. Einkaufsgesell. Beschränkt. Haftung, Flugschr. No. 4 [1915], Orig., pp. 24, fig. 1*).—This pamphlet discusses methods for conserving vegetables by natural drying, forced drying, salting, pickling, and various processes of canning. Recipes and detailed procedures for the various processes are described.

The laboratory kitchen recipes for putting up fruits, with directions, THEODORA M. CARRELL (*Poughkeepsie, N. Y.: Author, 1916, pp. 27*).—This pamphlet briefly describes the utensils necessary for putting up fruit and discusses the usual methods of canning and subsequent sterilization. Recipes and directions, which have been tested in the laboratory kitchen at Vassar College, for preparing jellies, jams, preserves and conserves, fruit juices, pickles, marmalades of citrus fruits, preserved fresh fruits, mincemeat, and tutti frutti are given.

The canning of fruits without sugar, HEDWIG HEYL (*Zent. Einkaufsgesell, Beschränkt. Haftung, Flugschr. No. 24 (1916), Orig., pp. 16*).—This pamphlet outlines procedures for the canning of fruits without sugar. Recipes for preparing marmalades, fruit juices, pickled fruits, relishes, and products canned in vinegar are included. A note on the drying of fruits is also given.

Some results of the practical application of sulphurous acid and selected yeast in the fermentation of California Wines, 1913 and 1914, W. V. CRUESS (*Off. Rpt. Sess. Internat. Cong. Vit., 1915, pp. 254–263*).—Extended analytical data are submitted from which the following conclusions are drawn:

"The quality and soundness of wines made in the ordinary commercial cellars can be raised very materially by the use of sulphur dioxid and pure yeast. Special technical knowledge is not necessary for their use and they can be applied by the average wine maker."

Influence of composition on effervescence of champagne. Preliminary investigations, R. W. BETTOLI and J. LA BELLE (*Off. Rpt. Sess. Internat. Cong. Vit., 1915, pp. 267–275, figs. 7*).—The authors have studied the influence of sugar, tartaric acid, citric acid, tannin, glycerin, and extract (solids) on the

"sparkle" of champagne. For determining the rate of the liberation of gas a Lunge gas volumeter was used. Chemical analysis of the wines examined included the determination of alcohol, acidity (free as tartaric, volatile as acetic, and fixed as tartaric), reducing sugars, solids, sugar-free solids, and tannin. The analytical results obtained are expressed in graphical and tabular form.

While the experiments described are of a preliminary nature and no definite conclusions are drawn, it is indicated that "sugar, tannin, and glycerin exert a marked retardative action on the effervescence, while with the tartaric and citric acids the effervescence seems to be prolonged and not hastened. The fixed acidity of the wines used in the experiments was already exceptionally high so that any effect due to acidity may not have been so noticeable as it would have otherwise been."

The coloring matter of cane juices.—A preliminary report, M. A. Schneller (*Louisiana Stas. Bul. 157 (1916), pp. 16*).—The material from which the conclusions previously noted (E. S. R., 35, p. 312) have been drawn is discussed in detail.

In addition it is concluded that "the polyphenol content of juices could be reduced by topping cane low, using tops for planting. This would result in a distinct improvement of the color of juices."

Secrets of meat curing and sausage making (*Chicago: B. Heller & Co., 1916, 3. ed., pp. 247, figs. 48*).—This booklet describes the slaughtering and dressing of hogs for the market; the curing of hams, shoulders, and bacon; the rendering of lard; and the slaughtering of animals on the farm; and outlines many recipes for the preparation of sausages, etc.

SOILS—FERTILIZERS.

Principles of plant nutrition and manuring, W. Kleberger (*Grundzüge der Pflanzenernährungslehre und Düngerlehre. Hannover: M. and H. Schaper, 1914, pt. 1, pp. XII+354; 1915, pt. 2, pp. IX+291, pls. 11*).—The first part of this work deals mainly with soils as regards their constitution, structure, and conditions, also modifications thereof. The second part deals with soils as a factor in plant nutrition and as modified by plant life, the concluding chapter dealing with the classification and relative values of soils.

Each of the two parts contains a bibliography.

The making of the soil, E. J. Russell (*Trans. Highland and Agr. Soc. Scot., 5. ser., 28 (1916), pp. 1–32, figs. 13*).—This article deals with the natural processes and artificial processes such as tillage, drainage, and fertilization involved in the formation of arable soil.

Agricultural soils and their composition, J. Puig y Nattino (*Rev. Min. Indus. Uruguay, 4 (1916), No. 20, pp. 58–111, pls. 5, figs. 8*).—This article discusses and compares French, Italian, and German methods of mechanical analyses of soil and reports the results of physical analyses of 74 samples of Uruguay soils.

Soil survey of Franklin County, Florida, C. N. Mooney and A. L. Patrick (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 31, fig. 1, map 1*).—This survey issued September 30, 1916, deals with the soils of an area of 346,240 acres in the Gulf coast region of central western Florida, the surface of which "is a flat, featureless plain, and only along the coastal borders and up the main streams is there any topographic relief. These borders apparently are higher and are well drained, while the interior of the county is flatwoods country comprising a large number of almost impenetrable bays or swamps. . . .

"The soils of the county are of marine sedimentary origin and are predominantly sandy. There are two general groups, the light-colored, well-drained soils and the poorly drained, or dark-colored, soils."

Including shell mounds, muck, coastal beach, tidal marsh, and swamp, 13 soil types of 6 series are mapped, of which the Hyde fine sand, the Plummer fine sand, and swamp cover, respectively, 34.3, 22.6, and 10.9 per cent of the area.

Soil survey of Jewell County, Kansas, L. E. Call, R. I. Throckmorton, C. O. Swanson, et al. (*Kansas Sta. Bul. 211 (1916), pp. 36, map 1*).—This report of a survey made in cooperation with the Bureau of Soils of the U. S. Department of Agriculture deals with the general characteristics and chemical composition of the soils of an area of 578,840 acres in northern Kansas.

"The soils of Jewell County fall naturally into four general groups: (1) Residual soils, or those derived from the underlying rocks; (2) loessial soils, or those formed from the weathering of wind-blown deposits; (3) soils of mixed loessial and residual origin; and (4) alluvial soils, or those laid down by streams." Nineteen soil types of 7 series are mapped, of which the Colby silt loam and silty clay loam cover 52.3 and 16.9 per cent, respectively. Average chemical analyses of the different soil types are also reported, which are taken to indicate that the potassium, phosphorus, and lime contents are relatively high, although the phosphorus is more available in the soil than in the subsoil. It is pointed out that the cultivated soils have lost from one-fourth to two-fifths of the nitrogen originally present in the virgin soil.

Some soils from the Kuala Pilah and Jelebu districts, J. Grantham (*Agr. Bul. Fed. Malay States, 4 (1916), No. 8, pp. 243–247*).—Mechanical and chemical analyses of five samples of padi soils, three samples of rubber soils, two samples of jungle soils, and one sample of white soil are reported and discussed.

Critical contribution on the origin of the Mediterranean red soils, E. Blanck (*Landw. Vers. Stat., 87 (1915), No. 4–5, pp. 251–314*).—This is a critical review and analysis of work bearing on the subject conducted by the author and others.

The results are taken to indicate that generally, where the presence of dolomite has caused the absence of humus, conditions are favorable to the formation of red soil, depending on the action of climatic factors which partially or wholly prevent humus accumulation. The part played in the formation of red soil by insoluble residues of limestone origin is considered of minor importance, since such residue forms only a small part of the red soil and can not account for iron accumulations. The latter are attributed to the metasomatic displacement of lime and to the powers of diffusion of iron solutions added from without.

Humification of compounds contained in vegetable organic matter, A. trusov (Trussoff) (*Selsk. Khoz. i Lîesov., 250 (1916), Mar., pp. 339–361*).—Experiments, especially with dry maple leaves, to determine the amount of humus formed during the decomposition of vegetable residues in surface soil are reported.

It was found that the content of water-soluble humus in decomposing organic matter varied, amounting to 1.93 per cent in maple leaves gathered soon after their fall. The plant residues contributed more actively to humus formation and the content of humus soluble in ammonia was larger during the earlier stages of decomposition. The relations between the amounts of humus soluble in water and in ammonia varied with different vegetable materials and periods of decomposition. Frequent drying of the leaves during decomposition decreased the humus content. During decomposition there was no increase in humus content after eight days, and after 156 days no water-soluble humus was found.

Measuring biological actions by the freezing-point method directly in the soil, G. J. Bouyoucos (*Science, n. ser., 44 (1916), No. 1124, pp. 65, 66*).—Experiments conducted at the Michigan Experiment Station on the influence of the decomposition of dried blood, cottonseed meal, and animal tankage in soils on the concentration of the soil solution as indicated by depression in the freezing point are reported. The fertilizers were added at the rates of 0.5 and 1 gm. per 800 gm. of soil.

It was found that "the decomposition of these nitrogeneous materials increased the depression, and hence the concentration, of the soil solution markedly, and the magnitude of the increase seems to vary with the nature of the material and quantity employed. In some other experiments the amounts of these nitrogenous materials were used, not in equivalent weight but in equivalent nitrogen content, and the freezing-point depression was measured at various intervals. The results show that dried blood reached its maximum decomposition first, followed by animal tankage and cottonseed meal, respectively. . . .

"It appears that the freezing-point method may be used to great advantage in making comparative studies of the decomposibility of various organic substances in the same kind of soil, or the decomposing power of different classes of soil on the same organic substance, or of the same soil differently treated, etc."

Effect of grinding soil on the number of micro-organisms, E. B. Fred (*Science, n. ser., 44 (1916), No. 1130, pp. 282, 283*).—Tests with silt loam, clay, sand, silt clay loam, sandy loam, medium sand, loam, muck, and garden soils to determine the influence of grinding on the number of micro-organisms showed that "grinding greatly reduced the number of bacteria except in silt loam. Apparently the greatest injury caused by grinding for one hour is noted in the case of sandy soils. When the soils were ground for 8 or 24 hours, there was an enormous decrease in the bacterial flora. . . . After 24 hours of grinding the soil was rendered almost free of bacteria. . . .

"Dilution counts on various culture solutions adapted to protozoa showed that the unground soils contained protozoa in dilutions greater than 1 to 10,000, while in many cases the ground soil failed to show any growth of protozoa. The garden soil contained protozoa in the first dilution, 1 gm. in 10 cc. of the medium. When ground for 24 hours this same soil did not show the presence of protozoa.

"From the results, it seems fair to conclude that grinding soil in a ball mill injures the soil micro-organisms. If this process is continued for several hours, the soil will be partially sterilized."

The gases of swamp rice soils.—III, A hydrogen-oxidizing bacterium from these soils, W. H. Harrison and P. A. Subramania Aiyer (*Mem. Dept. Agr. India, Chem. Ser., 4 (1916), No. 4, pp. 135–148, fig. 1*).—Continuing work previously noted (E. S. R., 33, p. 216), further studies were made on the bacteria in the film on the surface of swamp-rice soils, which had previously shown the ability to oxidize hydrogen.

Cultivation of a crude culture in Kaserer's medium (E. S. R., 18, p. 1028) under autotropic conditions and incubation in an atmosphere consisting of a mixture of carbon dioxid, methan, oxygen, and hydrogen yielded a culture composed of a mixture of two species of bacteria, one nonmotile and the other smaller. Further cultivation of the mixed culture in the medium to which organic matter was added led to the conclusion that the particular bacterium which was able to oxidize hydrogen was unable to exist in pure culture under autotropic conditions. "The mixed culture was plated out on mineral agar, to which 0.1 per cent sodium asparaginate had been added, and incubated in

an atmosphere of oxygen and hydrogen. Colonies developed of which a large number proved to possess the power of oxidizing hydrogen in the presence of soluble nitrogenous organic matter and which were found to consist of the larger nonmotile bacterium previously referred to."

The characteristics of the bacterium are described in detail, together with the experimental details of the work.

Relations between water and soil, H. FISCHER (*Internat. Mitt. Bodenk., 5* (*1915*), *No. 5–6, pp. 517–576, fig. 1; abs. in Chem. Abs., 10* (*1916*), *No. 10, p. 1391*).—Analyses of a number of soils, especially swamp soils, and soil waters which had undergone different natural changes and fertility treatments are reported and discussed with special reference to the judgment of the value of the soils. It is concluded that in judging the productiveness of a soil it is necessary, not only to analyze the soil and soil water and to conduct plat and pot tests and fertilizer experiments, but also to classify the soil with reference to regional and climatic conditions and thereby compare the results of natural and artificial changes.

Comparative tests of methods for determining cohesion, with special reference to marsh soils, C. MARQUIS (*Internat. Mitt. Bodenk., 5* (*1915*), *No. 5–6, pp. 381–516, figs. 14; abs. in Chem. Abs., 10* (*1916*), *No. 10, p. 1391*).—A comparison of methods of measuring cohesion in soils with different moisture and lime contents, including experiments on the draft of plows under varying soil conditions, is reported. It was found that moisture content was the most important factor determining the variation in cohesion values, and minimum cohesion was observed in each soil at a moisture content corresponding to its character.

Acidity and adsorption in soils as measured by the hydrogen electrode, L. T. SHARP and D. R. HOAGLAND (*U. S. Dept. Agr., Jour. Agr. Research, 7* (*1916*), *No. 3, pp. 123–145, fig. 1*).—Experiments conducted at the California Experiment Station with silty clay loam, fine sandy loam, sandy loam, gravelly loam, clay adobe, silty loam, and peat soils on the relation between soil reaction and the concentration of the hydrogen ion in soil suspensions and extracts are reported, together with the progress results of experiments on the influence of varying proportions of soil to water, grinding the soil, heating it at various temperatures, and of the addition of salts on the H-ion concentration. "Consideration has also been given to the relation of $HCO-^3$, $CO-^2$, and CO_2 to soil reaction as measured by the electrometric method. Experimental data have likewise been secured with respect to the lime requirement of soils and the so-called 'adsorption of bases.'" A hydrogen electrode apparatus for determining small differences in potential was used to measure hydrogen-ion concentrations in soil suspensions.

Hydrogen electrode measurements gave direct evidence that soil acidity is due to the presence of an excess of hydrogen ions in the soil solution. "The hydrogen-ion concentration of different soil suspensions was found to vary within wide limits, from a condition of high acidty to one of high alkalinity. Soils containing calcium in equilibrium with $HCO-_3$ and CO_2 have a very slightly alkaline reaction."

With one exception, grinding did not materially alter the hydrogen-ion concentration of the soil suspensions. Varying the proportion of soil to water produced only slight fluctuations in hydrogen-ion concentration in soil suspensions.

"The intensity of acidity decreases when the soils are heated at high temperatures. The insufficiency of the data concerning heating at 140° C. does not admit of positive conclusions, though there is indication that the H-ion concentration may be slightly increased by this treatment. . . .

"The addition of sodium chlorid, potassium chlorid, and barium chlorid to certain soil suspensions was found to increase the hydrogen-ion concentration." There was found to be apparently a simultaneous removal of positive and negative ions from solutions of various hydrates by soils.

A list of 35 references to literature bearing on the subject is appended.

Soil alkali studies: Quantities of alkali salts which prohibit the growth of crops in certain Utah soils, F. S. Harris (*Utah Sta. Bul. 145 (1916), pp. 21, figs. 16*).—In an extension to field conditions of studies previously reported (E. S. R., 34, p. 125), determinations of the total soluble salts, including chlorids, carbonates, and sulphates, to a depth of 4 ft. in soils from seven counties in Utah were made. The crops growing on the soils were wheat in five cases and oats and alfalfa one each. "Samples were taken from typical alkali spots, from parts of the same field producing good crops, and from places surrounding the bare spots where only about a half crop was produced." The results are reported graphically.

It was found that the highest concentration and the location of salts varied considerably, occurring in some soils in the surface foot and in others at depths of 2, 3, and 4 ft. The total soluble salts in the parts of the fields producing the best crops varied from 2,440 parts per million in Salt Lake County to 10,852 parts per million in Millard County, with an average of 5,089 for all seven counties. The parts of the field where the yield had been reduced to about half what it was in the better places varied in total soluble salts from 2,956 parts per million in Carbon County to 18,325 parts per million in Millard County, with an average of 9,263 parts per million for all the counties. The total salts varied in the bare places from 6,938 parts per million in Salt Lake County to 30,148 parts per million in Cache County, with an average of 14,397 parts per million. There was considerable variation in the chlorids and carbonates, but very much more in the sulphates, the latter running as low as 543 parts per million in Boxelder County and as high as 23,027 in Cache County.

The toxic limits for total salts were considerably lower in the eastern counties. "No crops grew where there were 14,397 parts per million of salts. . . . As an average of the three counties where sulphates were low, no crops were produced with a concentration of 10,709 parts per million of salts, while there was only half a crop with 6,455 parts per million."

[Studies on soils] (*California Sta. Rpt. 1916, pp. 59, 60*).—In studies by W. P. Kelley on the effect of sodium nitrate on soils, it was found that the continued use of this material resulted (1) in a well-defined deterioration in the physical properties of the soils, (2) in a rapid loss of soil calcium, and (3) in an unusually high content of soluble sodium in proportion to other bases in the water extracts from such soils. It was concluded that sodium nitrate reacts with calcium carbonate in soils to form small amounts of sodium carbonate.

Studies of nitrification in California soils are said to show the favorable influence of manure and leguminous cover crops and only a slight effect of inorganic fertilizers on nitrification. Leguminous cover crops are said to undergo much more rapid nitrification than barley or manure. The results of a comparative study of the nitrification of leguminous cover crops are taken to indicate that *Melilotus indica*, purple vetch, common vetch, and bur clover each contain about the same amounts of nitrogen and likewise undergo rapid nitrification. Canada field peas and Windsor beans, on the other hand, were somewhat inferior in this respect.

The results of studies on the movement of nitrates in soils are taken to indicate that nitrates are naturally formed in cultivated zones to the greatest extent and that where cover crops and manure are plowed down the porosity of

the soil permits more uniform diffusion and movement of nitrates into the substrata.

Comparison of the nitrifying powers of some humid and some arid soils, C. B. LIPMAN, P. S. BURGESS, and M. A. KLEIN (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 2, pp. 47–82*).—Studies conducted at the California Experiment Station on the nitrifying powers under incubator conditions of about 40 humid and 150 arid soils, of which at least one sample was obtained from each State in the Union, are reported. "The soil was used as a medium, and the forms of nitrogen employed were soil nitrogen, sulphate of ammonia plus soil nitrogen, dried blood plus soil nitrogen, and cottonseed meal plus soil nitrogen."

It was found that the nitrifying powers of soils of the arid region are no more intense than those of the humid region. It is considered possible that "the data [for soil nitrogen and dried-blood nitrogen] justify the further conclusion that the nitrifying powers of humid soils are greater than those of arid soils. . . . Arid soils nitrify the nitrogen of sulphate of ammonia and cottonseed meal with much greater vigor than do the humid soils. A reversal of efficiency is manifest between the two groups of soils as regards sulphate of ammonia and cottonseed meal on the one hand and dried blood and soil nitrogen on the other."

The washing out of nitrate from arable soil during the past winter, E. J. RUSSELL and A. APPLEYARD (*Jour. Bd. Agr. [London], 23 (1916), No. 1, pp. 22–27, figs. 2*).—Studies of the soils of several experimental fields after an unusually wet winter showed that the high winter rainfall caused a deflocculation of clay and a depletion of the stock of soil nitrates.

Experiments on the improvement of peat soils by adding mineral soils and lime, H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr., 29 (1915), No. 6, pp. 462–466*).—In experiments at Flahult it was found that the addition of a mixture of sand and loam to swamp soil increased the yield of hay. When sand alone was used better results were obtained with oats, timothy, and pasture grass when the sand was spread on the surface than when it was plowed into the soil. Turnips and flax responded best to liming on these soils and red clover and barley least.

Manuring for higher crop production, E. J. RUSSELL (*Cambridge, Eng.: Univ. Press, 1916, pp. [VI]+69, pls. 2, figs. 14*).—This is a popular book for English farmers on manures and soil management, which is intended especially to meet emergency conditions due to the European war. It is divided into five chapters.

Chapter 1, the improvement of the soil, deals with cultivation, liming, green manuring, and catch cropping. Chapter 2, the manure heap, deals with the storage, conservation, use, and time of application of manure and liquid manure. Chapter 3, artificial manures, deals with the composition and use of the well-known nitrogenous, phosphatic, and potassic fertilizers. Chapters 4 and 5 deal in turn with the practical manuring of arable land with reference to different common crops and the manuring of grass land.

Fertilizers, E. B. VOORHEES (*New York: The Macmillan Co., 1916, rev. ed., pp. XV+365, pls. 16, figs. 6*).—This is a revised edition of this book by J. H. Voorhees (E. S. R., 10, p. 942). The revision consists of the rearrangement of certain parts, the incorporation of considerable new matter, and the bringing up to date of old matter. A chapter on manures is included; the subject of lime is more fully treated; and more attention is given to the utilization of various by-products and waste products as fertilizers as well as to recently discovered phosphates and phosphate preparation, air nitrogen compounds, and

American sources of potash. Much new matter regarding the fertilizing of truck and market garden crops and other special crops has been added.

Soil fertility, its economic maintenance and increase, F. T. Shutt (*Canada Expt. Farms Bul. 27, 2. ser., (1916), pp. 13*).—This is an address to farmers' institute workers in which the fundamental principles in the economic maintenance and increase of soil fertility are enumerated and discussed. Special attention is drawn to the importance of the conservation and use of farm manure and of fertilizers as a supplement to manure. Analyses of various kinds of manure are given as follows:

Approximate average composition of manure (fresh) from various animals.

Kind of animal.	Relative proportions of solid excrement, liquid excrement, and bedding in manure.	Pounds per ton.	Nitrogen.	Phosphoric acid.	Potash.
			Per cent.	Per cent.	Per cent.
Horse	Solid excrement	1,200	0.55	0.30	0.40
	Liquid excrement (urine)	300	1.35	Trace.	1.25
	Bedding material	500	.50	.15	.60
	Total mixture	2,000	.60	.22	.58
Cow	Solid excrement	1,260	.40	.20	.10
	Liquid excrement (urine)	540	1.00	Trace.	1.35
	Bedding material	200	.50	.15	.60
	Total mixture	2,000	.57	.14	.49
Pig	Solid excrement	990	.55	.50	.40
	Liquid excrement (urine)	660	.40	.10	.45
	Bedding material	350	.50	.15	.60
	Total mixture	2,000	.49	.30	.45
Sheep	Solid excrement	1,206	.75	.50	.45
	Liquid excrement (urine)	594	.35	.05	2.10
	Bedding material	200	.50	.15	.60
	Total mixture	2,000	.90	.33	.95
Poultry	Solid and liquid excrement	1,900	1.00	.80	.40
	Bedding material	100	.50	.15	.60
	Total mixture	2,000	.97	.77	.41

Analyses of seaweeds collected on the Atlantic seaboard are also reported as in the following table:

Analyses of seaweeds collected on the Atlantic seaboard.

	Water.	Organic matter.	Ash.	Nitrogen.	Phosphoric acid.	Potash.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Fucus furcatus	63.49	27.93	8.53	0.468	0.108	2.025
F. vesiculosus	88.29	7.61	4.10	.182	.037	.615
Ascophyllum nodosum	75.14	19.30	5.56	.273	.070	.619
Porphyra laciniata	79.42	15.15	5.43	.928	.068	.619
Laminaria longicruris	88.30	7.15	4.55	.251	.134	1.546

Manurial values of concentrated foods in relation to cost of food in the production of milk, J. Mackintosh (*Jour. Bd. Agr. [London], 23 (1916), No. 3, pp. 209–224*).—Studies of the values of the manurial residues, conducted as a part of an investigation lasting two years into the cost of feed in the production of milk on 39 farms, are reported.

The total weight of feed used during the two years was 1,795 tons, and included decorticated cotton cake and meal, Egyptian cotton cake, compound

dairy cake and meal, linseed cake, dried grains, soy-bean cake and meal, and oats. The first year the net manurial value for all the farms equaled 0.33d. (0.66 ct.) per gallon of milk produced. In the second year the net manurial value was 0.36d. (0.72 ct.) per gallon of milk produced. The range of net manurial values per gallon of milk was from zero to 0.83d (1.66 cts.).

"A comparison of the results from the groups of farms shows that the methods of management of the liquid and solid manure is one cause of variation in the results from the individual farms, but at least two other factors must be taken into account. These are (1) the quantity of cakes and meals used, and (2) the variation in manurial value of individual cakes and meals."

A plan for testing efficiencies of fertilizers, P. L. Gile and J. O. Carrero (*Jour. Amer. Soc. Agron., 8 (1916), No. 4, pp. 247–255, fig. 1*).—In a further contribution to the subject (E. S. R., 31, p. 28), "it is proposed that tests of the efficiencies of different fertilizers furnishing the same element shall include applications of three to five different quantities of the standard fertilizer, and that from the data of the tests so planned the efficiencies be calculated on the basis of the relative quantities of the different fertilizers required to produce the same increased yields. It is pointed out that the usual method of conducting such tests and the usual method of calculating efficiencies may be subject to some error, as they are based on an assumption concerning the law of minimum, namely, that the curve of increased growth with increasing amounts of the fertilizer in minimum will be a straight line. This assumption is sometimes false, as the curve may take a variety of forms. . . .

"[The proposed method] being based on no assumption concerning the law of minimum, an accurate comparison is possible irrespective of how the yield increases with increasing amounts of the fertilizer in minimum. The form of the curve, plotted from the increased yields produced by increasing amounts of the standard fertilizer, shows when a calculation of relative efficiencies is allowable, and gives some idea of the accuracy of the comparison. As the proposed method involves the idea of always comparing yields of approximately equal magnitudes, an analysis of the crop and determination of dry matter are not so important as in the old method. This principle of the proposed method is of particular value for vegetative tests in pots where large and small yields are subject to somewhat different conditions in respect to ratio between soil and root volume and total amount of mineral matter supplied in the water."

[Fertilizer experiments], E. F. Gaskill (*Massachusetts Sta. Rpt. 1915, pt. 1, pp. 37a–44a*).—The results of the twenty-sixth year of an experiment with clover and grass on the relative value of barnyard manure, sodium nitrate, ammonium sulphate, and dried blood as sources of nitrogen are reported, together with a summary of the whole period. "On the basis of 100 for nitrate of soda, the relative standing of the different nitrogen plats and no-nitrogen plats, as measured by total yield during the season, was as follows: Dried blood, 102.46; no nitrogen, 99.61; sulphate of ammonia, 99.48; and manure, 99.1; [and] for the 26 years, nitrate of soda, 100; manure, 76.47; dried blood, 75.83; and sulphate of ammonia, 57.93. Considering the relative standing of the different nitrogen fertilizers on the basis of yields per acre with a mixed crop of clover and grass there is very little difference between the different materials, and the no-nitrogen plats gave yields about as large as those receiving nitrogen."

Experiments with asparagus, blackberries, raspberries, currants, rhubarb, potatoes, mangels, and alfalfa on the relative value of potassium sulphate and chlorid as sources of potash gave, except in the case of asparagus, results in agreement with those of previous years. "Considering the different crops grown during the 23 years of the experiment, the muriate has proved the better

source of potash for the following: Asparagus (11 years), currants (4 years), mangels (2 years), sugar beets (1 year), corn, ensilage (1 year), corn stover (7 years), sweet-corn stover (1 year), squashes (3 years), carrots (2 years), onions (2 years), celery (1 year), oat hay (1 year), and vetch and oats (2 years). The sulphate has proved the better source of potash for the following crops: Asparagus (1 year), blackberries (10 years), raspberries (10 years), strawberries (11 years), rhubarb (12 years), potatoes (12 years), corn, grain (7 years), sweet corn, ears (1 year), cabbages (10 years), soy beans (4 years), alfalfa (4 years), crimson clover (1 year), common red and alsike clover (1 year), and mammoth red clover (1 year)."

The results in the twenty-sixth year of a comparative test of two fertilizer mixtures, one high in potash and low in phosphoric acid and the other high in phosphoric acid and low in potash, showed that for the mixture rich in phosphoric acid the yield of crib-dried corn was 46 bu. and the yield of stover 5,420 lbs. per acre, and for the mixture rich in potash, 35.1 bu. of corn and 5,060 lbs. of stover per acre.

The results of the eighth year of a comparison of ammonium sulphate and sodium nitrate as a top-dressing for permanent mowings were "in favor of the nitrate of soda for the first crop, with very little difference between the two for the second crop, and the no-nitrogen plat producing more rowen than either the nitrate of soda or sulphate of ammonia plats. . . . These results . . . indicate in a striking way that beneficial results are obtained by top-dressing with sulphate of ammonia and nitrate of soda, and that the results are immediate but not lasting."

The results of an experiment to study the relative value of different sources of lime on the basis of equal applications of combined calcium and magnesium oxids are briefly noted, medium green soy beans being grown for seed. The following comparative yields per acre are reported: With hydrated lime, 31.2 bu. of seed and 2,484 lbs. of straw; with marl, 30 bu. of seed and 2,435 lbs. of straw; with ground limestone, 30.02 bu. of seed and 2,359 lbs. of straw; with no lime, 28.86 bu. of seed and 2,273 lbs. of straw; and with limoid, 35.25 bu. of seed and 3,209 lbs. of straw.

Other general data are also included on the effect of the continued use of fertilizers containing single plant food elements and of different combinations of plant food elements on different crops, and the relative value of different fertilizer rotations for top-dressings of grass land.

Sources of nitrogen compounds in the United States, C. G. Gilbert (*Smithsn. Inst. Pub. 2421* (*1916*), *pp. 12*).—This paper discusses the nitrogen situation in the United States and briefly describes the arc method, the cyanamid and Haber processes, and the by-product ammonia method of obtaining nitrogen compounds. The cyanamid process and the by-product coking operation are thought to offer the greatest possibilities in the United States for meeting the agricultural and other requirements for nitrogen.

Fixation of air nitrogen and the importance of the resulting fertilizer to agriculture, L. Seidler (*Fühling's Landw. Ztg., 64* (*1915*), *No. 21–22, pp. 543–556*).—A number of processes for the fixation of air nitrogen are described and discussed.

The preparation of superphosphate from phosphorites from Saratov and Perme, N. P. Koblykov (*Trudy Kom. Moskov. Selsk. Khoz. Inst. Izslied. Fosforitov., Ser. II, 5* (*1915*), *pp. 16–22*).—Experiments with the two types of phosphorite are reported which show that the Perme phosphorite yielded a product containing 16.2 per cent water-soluble phosphoric acid and the Saratov phosphorite from 11.7 to 11.8 per cent.

Citrate solubility as a measure for the effectiveness of different Thomas phosphates, T. PFEIFFER (*Fühling's Landw. Ztg., 65 (1916), No. 3–4, pp. 81–92, fig. 1*).—The author reviews and analyzes the results of several experiments with a number of different Thomas phosphates, and shows that in the majority of cases a definite relation existed between the citrate solubility of the Thomas phosphates and their effectiveness. In one case this assumed the form of a mathematical expression; that is, the effective value of the different Thomas phosphates represented a logarithmic function of their content of citrate-soluble phosphoric acid.

Potash in the banana stalk, R. H. ELLIS (*Jour. Soc. Chem. Indus., 35 (1916), No. 8, pp. 456, 457*).—Analyses of banana stalks indicated that a ton of banana stalks yielded 188 lbs. of dry matter containing 13.7 per cent potash. It is noted that the dried banana stalks contain about two-thirds as much potash as the dried kelp of the American Pacific coast. Similar results obtained by A. J. Hanley at Leeds University are also noted.

Note on the presence of potash in banana skins, R. H. ELLIS (*Jour. Soc. Chem. Indus., 35 (1916), No. 9, p. 521*).—An examination of banana skins showed a total potash content of 1.05 per cent, the dry matter containing 9.03 per cent of potash. See also the above note.

A few experiments in the slacking and keeping of lime from east and west Götland, H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr., 30 (1916), No. 2, pp. 170–216, pls. 4, figs. 15*).—This is a report of experiments on various methods of slaking lime. It is pointed out that lime must be slaked in small quantities, using known amounts of water. The fineness of slaked lime was found to depend on the manner and degree of slaking, from 70 to 80 per cent of particles of a size less than 0.2 mm. being obtained from well-slaked lime. The finer lime powder was found to contain more hydrate and less carbonate and silicate than the coarser powder.

Instructions on storing burned lime are also included.

Methods of applying lime, J. HENDRICK and J. M SMITH (*Trans. Highland and Agr. Scot., 5. ser., 28 (1916), pp. 145–157*).—Instructions regarding the application of shell lime, lime compost, ground lime, calcium carbonate, shell sand, and marl are given.

Official report on agricultural lime licensed, inspected, and analyzed during the year 1915 (*Columbus, Ohio: Bd. Agr., 1916, pp. 53, fig. 1*).—This bulletin gives general information on the purchasing and use of agricultural lime, and reports the results of actual and guarantied analyses of 58 samples of agricultural limes collected for inspection in Ohio during 1915. A list of agricultural lime manufacturers and dealers in Ohio and the text of the Ohio agricultural lime law are also given.

Lime in 1915, G. F. LOUGHLIN (*U. S. Geol. Survey, Mineral Resources of the United States, Calendar Year 1915, pt. 2, pp. 245–264*).—This report, issued August 19, 1916, deals with the production, use, imports, and exports of lime in the United States during 1915.

"The lime manufactured and sold in the United States in 1915 amounted to 3,589,699 short tons, valued at $14,336,756. This was an increase of 208,771 tons, or 6 per cent, in quantity, and of $1,067,818, or about 9 per cent, in value compared with sales in 1914. . . . The five leading States in 1915 were, according to quantity of lime sold, Pennsylvania, Ohio, Virginia, West Virginia, and Wisconsin; according to value, Maine ranked third and Wisconsin sixth. . . .

"The quantity of lime for fertilizer in 1915 decreased about 5 per cent in quantity from the figure of 1914, but was considerably higher than in any other preceding year; the value in 1915, however, was 1 per cent greater than that of 1914, and was the greatest yet attained. The average price per ton increased

18 cts. over that of 1914. . . . Lime for fertilizer was sold in 1915 in 29 of the 43 lime-producing States, and represented about one-sixth of the total quantity and one-seventh of the total value of lime sold. Pennsylvania was the leading State, with sales valued at nearly $1,000,000. . . . Besides burned lime, there were also sold for fertilizer in 1915 810,399 short tons of pulverized limestone, valued at $893,530.

Gypsum in 1915, R. W. Stone (*U. S. Geol. Survey, Reprint from Mineral Resources of the United States, Calendar Year 1915, pt. 2, pp. 151–159*).—This report deals with the production and use of gypsum in the United States during 1915, and states that "although the output of gypsum mined decreased in 1915, the decrease was only a little more than 1 per cent and the decrease in value of products marketed was only about 4 per cent. . . . The quantity mined exceeded that of all previous years except three, 1912, 1913, and 1914. . . . There was also an unusual increase in the quantity sold as land plaster."

The action of manganese under acid and neutral soil conditions, J. J. Skinner and F. R. Reid (*U. S. Dept. Agr. Bul. 441 (1916), pp. 12, figs. 3*).—A six years' field test of manganese sulphate used at the rate of 50 lbs. per acre on an acid silty loam soil is reported.

It was found that the effect of the manganese sulphate each year was not beneficial to wheat, rye, corn, cowpeas, or potatoes. The soil required from 1,780 to about 2,750 lbs. of calcium carbonate per acre to neutralize the first 6 in. It is also deficient in organic matter, of poor physical condition, and has a poor oxidizing power. The processes of oxidation were retarded by manganese in most cases of acid conditions in the soil.

Studies on the same plats kept neutralized with lime for the three years following the experiment with the soil in an acid condition indicated that additions of manganese increased the yields of wheat, rye, timothy, beans, corn, and cowpeas, while no difference was produced in the potato crop. The oxidative power of the neutralized soil was also increased by manganese.

"These results on the behavior of manganese as a so-called catalytic fertilizer when acting under acid or neutral soil conditions show that no profitable return is to be expected in soils of a persistent acid tendency until such soils are limed."

The American fertilizer handbook (*Philadelphia: Ware Bros. Co., 1916, 9. ed., pp. [398], figs. 2*).—This handbook contains the usual data and information relating to the fertilizer industry (E. S. R., 34, p. 29). Among the more important special articles included are the following: Fertilizers: What They Are—How to Apply Them, by H. G. Bell; The Sulphuric Acid Industry: Conditions in the Trade—New Construction—Brief Review of Recent Literature and Recent Patents—Statistics for the United States, by A. N. Fairlie; Possible Sources of Potash in America, by F. K. Cameron; Potash Salts, 1914, by W. C. Phalen; Preventable Losses in Fertilizer Plants, by S. J. Martenet; Sulphur and Pyrite in 1914, by W. C. Phalen; The Cyanamid Industry—World Status, by E. J. Pranke; The Production of Phosphate Rock in 1914, by W. C. Phalen; The Cottonseed Oil Industry; An Interesting and Unusual Year—Conditions Have Necessitated Many Changes in Milling Methods—The Future of the Industry, by T. C. Law; The Products and Composition of Cotton Seed, by T. C. Law; and The Western Animal Ammoniate Market: An Unprecedented Advance of Prices for Blood and Tankage During the Fall of 1915—The Demand for Animal Ammoniates Greater than the Production—Monthly Review from May 1, 1915, to April 30, 1916, by J. H. Schmaltz.

Official report on commercial fertilizers licensed, inspected, and analyzed during the year 1915 (*Columbus, Ohio: Bd. Agr., 1916, pp. 221*).—This bulletin gives general information regarding the manufacture, selection, purchase, and

use of commercial fertilizers in Ohio, and reports the results of actual and guarantied analyses of 565 samples of fertilizers and fertilizing materials offered for sale in Ohio during 1915.

Analyses of commercial fertilizers, R. N. BRACKETT ET AL. (*South Carolina Sta. Bul. 187 (1916), pp. 68*).—This bulletin contains the results of actual and guarantied analyses and valuations of 1,593 samples of fertilizers and fertilizing materials collected for inspection in South Carolina during 1915 and 1916 with the usual explanatory notes.

AGRICULTURAL BOTANY.

Influence of certain carbohydrates on green plants, L. KNUDSON (*New York Cornell Sta. Mem. 9 (1916), pp. 5–75, figs. 11*).—Experiments are described in which a number of plants were cultivated in nutrient media to which various forms of sugar were added, the plants being grown in plugged test tubes, cylinders, or flasks.

Corn (*Zea mays*) was found able to absorb through its roots and to assimilate certain sugars, which resulted in increased growth of the plant. The sugars in the order of their beneficial effect on the plants when grown in the light were glucose and fructose, saccharose, and maltose. In the dark, glucose gave the most beneficial results.

With Canada field peas (*Pisum sativum*), growth was found to respond markedly to the presence of sugars, the order of their beneficial influence being saccharose, glucose, maltose, and lactose. Timothy was found to utilize glucose and saccharose, but not lactose when grown in the light. With this plant grown in the dark, all the sugars seem to be utilized. Experiments with radish confirm earlier investigations, glucose, saccharose, maltose, and lactose being utilized. Vetch (*Vicia villosa*) grown in the dark utilized the various disaccharids. When grown in the light, the order of the favorable influence of the different sugars was saccharose, glucose, maltose, and lactose. Cabbage grown in the presence of maltose showed increased growth, and the same was true for sweet clover with increased concentrations of glucose or saccharose and for crimson clover with maltose.

Vetch plants showed increased growth with increase in concentration of sugars, and these plants were found to absorb glucose from an extremely weak solution. Certain forms of sugars were found toxic in various degrees, and antagonistic actions were observed between different forms of sugars.

In connection with the experiments with vetch, the respiration of the plants was determined. It was found that saccharose and glucose were much alike in their effect, while maltose produced a lessened evolution of carbon dioxid.

An extensive bibliography is given.

Studies on the formation and translocation of carbohydrates in plants (*Jour. Agr. Sci. [England], 7 (1916), No. 3, pp. 255–384, figs. 18; abs. in Gard. Chron., 3. ser., 59 (1916), No. 1526, p. 172*).—This report in three parts, as indicated below, of work done at Rothamsted Experimental Station, had for its object to throw light on the fundamental problems of carbohydrate formation, transfer, storage, transformation, and utilization. Credit for furnishing a complete account of work done as late as 1893 is given to Brown and Morris (E. S. R., 4, p. 984; 5, pp. 127, 344).

I. *The carbohydrates of the mangold leaf, W. A. Davis, A. J. Daish, and G. C. Sawyer* (pp. 255–326).—This section deals with a study of the formation and translocation of the sugars in the mangold under actual conditions of growth. Starch is said to be absent from the leaf after very early stages of growth of the root. During all hours and at all stages, maltose is absent from

leaf, midribs, and stalk. Saccharose exceeds hexoses somewhat in the very young leaves, the reverse being true later in the season. In the midribs and stalk, saccharose remains practically constant throughout the season, being greatly exceeded by the hexoses, which show great diurnal and seasonal variation. During the daytime, the curve of the proportion of saccharose follows the curve of the temperature, while the rise of the curve of hexoses exceeds that of the curve of the temperature.

The facts are thought to support the view that saccharose is the primary sugar formed under the influence of chlorophyll in the leaf mesophyll. Before translocation, it is transformed into hexoses in the veins, midribs, and stalks, the proportion of hexoses increasing as the material approaches the root which it enters as hexose. It is there reconverted into saccharose, in which form it can not leave the root until reconverted for use in the second season's growth. It is considered improbable that the synthesis of hexoses to saccharose is effected by invertase through a process of reversible zymo-hydrolysis, as invertase is entirely absent from the root. Pentoses, which form only a small proportion of the total sugars in the tissues, are thought to be formed from hexoses and to be the precursors of the pentosans.

II. *The dextrose-levulose ratio in the mangold*, *W. A. Davis* (pp. 327–351).—In this work, it is said to have been found that in the extracts of mangold leaves and stalks optically active impurities are always present which are not precipitated by basic lead acetate and which hence vitiate the estimation of dextrose and levulose. These substances are possibly acid amids or amino-acids which form soluble lead salts, and occur much more abundantly in the midribs and in the stalks than in the leaves. When the ratio of dextrose to levulose is greater than unity (the value to be expected if they are formed into saccharose by inversion), it is thought that the apparent dextrose present is increased by the presence of a dextrorotatory impurity, possibly glutamin. When the ratio is less than unity, as at certain times of day, a levorotatory impurity is thought to predominate. In midribs and stalks, and especially near the bases of the latter, the dextrose appears (probably on account of the impurity above mentioned) to exceed largely the levulose. Apparent fluctuations in the ratio of dextrose to levulose are thought to be due to fluctuations in the optically active impurities rather than in these sugars themselves. These apparent fluctuations show some diurnal regularity. The presence of at least two optically active substances at different hours is thought to be indicated. It is provisionally held that the dextrose and levulose exist in the leaves and stalks as invert sugar, and travel in nearly or exactly equal proportions to the root, where retransformation into saccharose occurs. Which of these sugars is the better adapted to tissue formation or to respiration is not considered as settled by studies thus far reported.

III. *The carbohydrates of the leaf and leaf stalks of the potato. The mechanism of the degradation of starch in the leaf*, *W. A. Davis and G. C. Sawyer* (pp. 352–384).—It is stated that in potato leaf the increase of saccharose, the principal sugar present when the tubers begin to develop, goes on uniformly from sunrise to 2 p. m., following approximately the temperature curve, but showing a steady decline during the rest of the 24 hours.

Hexoses appear in the leaves in very small amounts, generally less than 1 per cent of their total dry weight. Fluctuations in their amount are explained by their conversion into starch or the reverse change. Hexoses begin to increase in the leaf as soon as saccharose has reached its maximum at 2 p. m., presumably owing to hydrolysis of the saccharose to invert sugar. Dextrin, appearing at the same hour, increases regularly to 6 p. m., when true starch

also reaches a maximum. Both of these then fall rapidly to a minimum of about 0.2 per cent just after midnight, the starch apparently changing directly to dextrose, which shows a corresponding increase in the leaf.

In the stalks, reducing sugars predominate greatly over saccharose. As in the case of the mangold, it is probable that cane sugar is the first sugar formed in the leaf and that it is hydrolyzed by invertase in the veins, midribs, and stalks for the purpose of translocation. As in the mangold, the determination of the true proportions of dextrose and levulose is prevented by the presence of soluble, optically active substances.

Maltose is invariably absent from the leaf of the potato plant and the leaves of other plants which form much starch in the leaf. The degradation of starch in the leaves is thought to be effected by a mixture of enzyms similar to the enzyms of *Aspergillus oryzæ.* Maltose is always present in relative excess so that starch is degraded completely to dextrose, the series of changes being starch,⟶ dextrins,⟶ maltose,⟶ dextrose.

Physiological observations on alkaloids, latex, and oxidases in Papaver somniferum, R. H. TRUE and W. W. STOCKBERGER (*Amer. Jour. Bot., 3 (1916), No. 1, pp. 1–11*).—Presenting the results of work done during 1902 to 1905, but afterwards interrupted, the authors state that in the case of *P. somniferum* the oxidase reaction is most active in the upper parts of the plant, especially in the floral structures, capsules, and actively growing parts. In this respect it parallels the distribution of the latex, which in itself is most active. The peroxidase reaction shows less variation in intensity in the different regions. Oxidase seems to be inactivated during the course of its action, as has been noted also in case of Irish potato. This appears to indicate that the oxidase reaction is not caused by a catalyzing agent. Intensity of oxidase reaction roughly paralleled the alkaloid content except in the root, where the latter was relatively the higher. Alkaloids seem not to exist as such in the poppy, but to appear as products of the oxidase action on the constituents present in the latex reacting in the presence of oxygen. Alkaloids of *Atropa belladonna* differ from those of the poppy in that they are found in structures dried out of contact with free oxygen and appear to exist ready formed in the plant.

A substance coagulating inulin and accompanying it in vegetable tissues, J. WOLFF (*Compt. Rend. Acad. Sci.* [*Paris*], *162 (1916), No. 14, pp. 514–516*).—The author claims to have found in roots of *Cichorium intybus* and in tubercles of *Dahlia variabilis* a substance which coagulates very actively the juices extracted from these plants and precipitates inulin from the solutions. For this agent the name inulo-coagulase is proposed. After 1 hour of coagulation, the precipitated inulin represented 35 per cent, and after 18 hours 75 per cent of the total quantity.

The constitution of anthocyanins, R. WILLSTÄTTER (*Ber. Deut. Pharm. Gesell., 25 (1915), No. 8, pp. 438–449; abs. in Rev. Gén. Sci., 27 (1916), No. 7, p. 199*).—Summarizing in this address the results of work recently done by himself and his collaborators, the author states that of about 20 anthocyanins thus far studied, 6 were obtained from fruits, the rest from flowers. The anthocyanins appertain to the oxonium salts. In all cases, these substances were found as glucosids and, by treatment, gave for each case a sugar and a coloring matter. These coloring matters have been termed anthocyanidins. Several are designated as to their origin and are discussed. Chemically, they are said to resemble closely the anthocyanins, which are widely distributed in nature.

Studies on the medium of exchange between roots and soil and among tissues in the plant, P. MAZÉ (*Ann. Inst. Pasteur, 29 (1915), No. 12, pp. 601–632; 30 (1916), No. 3, pp. 117–140, figs. 3*).—Having continued studies previously noted (E. S. R., 31, p. 221), the author states that the mechanism of absorption of nutritive substances from natural or artificial solutions does not include osmosis, the factors apparently operative in the introduction of nutritive substances into circulation being the motility of protoplasm and molecular attraction. The exchanges are possible when the nutritive medium contains all the material necessary to the plant in definite concentration. Incomplete solutions and distilled water introduced directly into the vascular bundles behave as toxic agents. Plasmolysis should be regarded as a phenomenon of coagulation. Osmotic action does not occur between living cells and external media. Absorption of sap is regulated by the chemical activity of the plant. Such phenomena as sap pressure, bleeding, and loss of turgescence are expressions of variation in the pressure within the plant, resulting from want of equilibrium between absorption and transpiration. Phototropic orientation in the stems is due to inequalities of pressure caused by unilateral illumination. Circulation of elaborated sap is assured by the turgescence in assimilating cells, which is periodic, as is sap movement.

It is claimed, in brief, that exchanges between plant and medium and among plant tissues are brought about by the play of mechanical factors, among which the motility of protoplasm predominates by reason of the part it plays in the control of permeability.

The exchange of ions between the roots of Lupinus albus and culture solutions containing three nutrient salts, R. H. TRUE and H. H. BARTLETT (*Amer. Jour. Bot., 3 (1916), No. 2, pp. 47–57, figs. 3*).—In continuance of previous accounts of work with *L. albus* (E. S. R., 34, p. 224), the authors report studies dealing primarily with mixtures of three salts. Two groups of experiments are reported, one employing the nitrates of potassium, calcium, and magnesium, the other employing monopotassium phosphate, calcium nitrate, and magnesium sulphate, each experiment including 36 cultures, each with a concentration of 140 $N \times 10^{-6}$.

It is stated that in general seedlings of *L. albus* absorb more salts from mixtures of potassium, calcium, and magnesium nitrates than from equally concentrated solutions containing one or two of these salts. The solutions of the three nitrates found most favorable to absorption were much inferior to corresponding solutions in which the three anions, $H_2PO_4^-$, NO_3^-, and $SO_4^=$, were present. The roots absorbed about 50 per cent of the salts from the best solutions of the mixed nitrates and 85 per cent from those of the three anions. In solutions of the mixed nitrates, as in those of the other compounds named, the best absorption occurs when no single ion is greatly in excess, although within a very wide range of variation in proportion the roots absorb with almost equal efficiency.

The antagonistic action of salts in plants, J. G. MASCHHAUPT (*Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefstat. [Netherlands], No. 19 (1916), pp. 1–60, pls. 5, fig. 1*).—This is largely a critical discussion of findings and views on the antagonism of salts in nutritive media, listing over 60 contributions on the subject.

Immobility of iron in the plant, P. L. GILE and J. O. CARRERO (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 2, pp. 83–87*).—As a result of experiments at the Porto Rico Experiment Station with rice grown in nutrient solutions, the authors have concluded that iron is not transferred from leaf to leaf under conditions where the plant is insufficiently supplied with iron. It is

not claimed that the nontranslocation of iron is a general rule, but the authors' observations on rice and pineapples indicate that iron, after once being transported to the leaves, becomes immobile.

The poisonous influence of lithium salts on plants, H. Frerking (*Flora [Jena], n. ser., 8 (1915), No. 4, pp. 449–453*).—It is stated that lithium, like magnesium, is poisonous to organisms requiring calcium, but not to calcium-free algæ and fungi. The poisonous influence of lithium is more pronounced than that of magnesium. While the influence of magnesium can be annulled by the employment of calcium salts, that of lithium is only retarded in this way.

The orientation of primary terrestrial roots with particular reference to the medium in which they are grown, R. M. Holman (*Amer. Jour. Bot., 3 (1916), No. 6, pp. 274–318, figs. 7*).—An account is given of a study, principally as relating to the vetch, lupine, and pea, which gave concordant results as regards the behavior of the root tip in relation to the media employed.

It is stated that differences in the amount of water in the media did not affect the behavior of the roots in this regard. Changes of geotonus due to their stay in air were not shown to affect root direction. The failure of the roots in air to reach the vertical appears to be due to the absence of mechanical resistance to the advance of the root tip in this medium. Secondary curvature of the roots in earth, sand, sawdust, sphagnum, or other such media, is complete, because resistance in these media causes passive depression of the root and prevents complete flattening of the tip curvature. Thigmotropism is not a factor in the difference in the behavior of roots in air and in earth or other nonfluid media. Resistance in the medium influences not only secondary but primary curvature, that is, curvature directly following the placing of the root in a position of stimulation.

The thermometric movements of tree branches at freezing temperatures, C. C. Trowbridge (*Bul. Torrey Bot. Club, 43 (1916), No. 1, pp. 29–56, figs. 19*).—Summarizing observations which are considered to have made some advance in the study of the influence of temperature on branch movement, the author states that depression of the branches of *Tilia europæa* begins at or just above 32° F. and continues at least as far as 0°, the lowest point at which observations were made. The atmospheric humidity has a negligible influence in this respect. Below 32° there is a stiffening of the branch, offering resistance to the depression. The width of longitudinal frost cracks, after they become established, corresponds somewhat to the temperature below 32°. There are indications that the bending is closely related to the process that produces the frost cracks.

Platanus orientalis and *Paulownia tomentosa* show scarcely a trace of the thermometric movement exhibited by the linden.

The mechanism of movement and the duration of the effect of stimulation in the leaves of Dionæa, W. H. Brown (*Amer. Jour. Bot., 3 (1916), No. 2, pp. 68–90, fig. 1*).—It is stated that leaf closure in Dionæa is due largely to an increase on the ventral or convex side of the leaf in cell size, corresponding to a stretching of the cell walls which is soon rendered permanent by growth, and that leaf opening is due to the slow enlargement, likewise corresponding to growth, of cells on the dorsal or concave surface. Stimulation of the leaf is followed by a great acceleration of growth, and apparently immediately by a decrease in osmotic pressure of the dorsal cells resulting in the passage of water from these to those of the ventral region. Starch is deposited abundantly in the dorsal cells soon after closure occurs. Leaves killed in boiling water just after closure open again if transferred through alcohol to xylene and close again when returned to water.

The mechanism of movement in Dionæa leaves shows many points of apparent similarity to that of geotropic curvatures. At 21° C., two mechanical stimuli are usually necessary to produce closure, an increase in the time interval requiring increase in the repetitions of the stimuli.

Sexual variations of the inflorescences and flowers in cultivated Codiæum, J. Chifflot (*Compt. Rend. Acad. Sci.* [*Paris*], *162* (*1916*), *No. 14, pp. 508–511*).—Summing up the results of his observations, the author cites that Codiæum, which is normally monœcious under cultivation, has shown the formation of female flowers from the second generation on male inflorescences, the formation of male flowers from the second generation on female inflorescences, and the formation of inflorescences which were bisexual from the first and of flowers which were hermaphrodite from the first.

Hybridization between a wild crucifer and a cultivated crucifer with tuberous roots, Mlle. Trouard-Riolle (*Compt. Rend. Acad. Sci.* [*Paris*], *162* (*1916*), *No. 14, pp. 511–513*).—It is stated that crossing the wild plant, *Raphanus raphanistrum*, with the cultivated species, *R. sativus*, gave in the first and in the second generation the same product which was obtained from the reciprocal cross. The plants of the first generation were more or less intermediate between the parents. Those of the second generation segregated, about two-thirds or more being tuberous-rooted, while some reverted to the wild type and some showed a mixture of characters. In some cases seeds of the same pod differed greatly. Crossing the wild plant with a hybrid obtained from varieties of cultivated plants gave in the second generation the wild parent, the original hybrid, and intermediate forms suggesting the ancestry of the hybrid parent.

It is thought that hybridization may prove to be an excellent means of accomplishing the tuberization of the wild forms.

Recolonization of cultivated land allowed to revert to natural conditions, Winifred E. Brenchley and Helen Adam (*Jour. Ecology, 3* (*1915*), *No. 4, pp. 193–210, figs. 2*).—This is a study carried on for several years of two wilderness areas left in 1882 with a standing wheat crop, which was permitted to seed itself but which had almost completely died out after four years. The changes which took place during each year and during successive years are discussed in connection with drainage and other factors.

A text-book of general bacteriology, E. O. Jordan (*Philadelphia and London: W. B. Saunders Co., 1916, 5. ed., rev., pp. 669, pl. 1, figs. 177*).—This is the fifth edition of the general text-book by this author, previous editions of which have been noted (E. S. R., 32, p. 371). The present edition has been revised and considerable additions made to certain chapters, particularly those relating to disinfection and the testing of disinfectants, and a new chapter on typhus fever has been inserted.

Aspergillus niger group, C. Thom and J. N. Currie (*U. S. Dept. Agr., Jour. Agr. Research, 7* (*1916*), *No. 1, pp. 1–15*).—The recent discovery by the writers that certain species of Penicillium are able to form oxalic acid led to a study of the black form species of Aspergillus. About 20 strains or species were examined, and all were found to possess in some degree the ability to form oxalic acid when grown in Czapek's solution. Culture experiments with 10 strains led the authors to the conclusion that there are many strains or varieties of black Aspergillus which differ markedly in the production of oxalic acid. Comparative studies of the colonies did not correlate the differences in acid production with the morphology of the organisms. The members of this group were found to grow under a wide range of cultural conditions and to exhibit distinct differences, this fact being considered to harmonize with the conclusion of Schiemann that *A. niger* is an unstable or mutating group comparable with Œnothera (E. S. R., 28, p. 430).

The colony characters and the morphology of this group are described, after which alphabetical lists of the species, with citations of publications, are given of all the forms which have been described as black or brown.

Agar agar for bacteriological use, H. A. Noyes (*Science, n. ser., 44 (1916), No. 1144, pp. 797, 798*).—The author claims that the increased acidity due to autoclaving and to titration made in hot solutions can be made the basis of selecting agar agar for laboratory use.

FIELD CROPS.

[Field crop experiments] (*Kansas Sta. Rpt. 1915, pp. 13, 14, 22, 23, 43, 44*).—Experiments on the effect of seed bed preparation on the yields of wheat (E. S. R., 34, p. 632) showed that the highest yield in 1914 was obtained where the seed bed was double disked in July and plowed deep in August.

Over 940 tests of varieties and head selections of small grain were made, together with rate- and date-of-seeding tests. An improved strain of wheat developed at the station outyielded both Turkey and all local varieties of wheat. Sweet sorghums produced 11.67 tons more silage and 4.57 tons more dry stover than Kafir corn. Sudan grass planted in 7- and 10-inch drills produced three cuttings, with a total of 8.25 tons of field-cured hay per acre.

The development of drought-resistant strains of corn has been continued with 32 third-generation strains segregated from Hybrid 58. The ratio of the weight of leaves and stems to the weight of the root system of milo maize, Kafir corn, and corn was found to be 9.6, 10.9, and 9.6, respectively.

At the Colby substation, 11 varieties of sorghums and 10 varieties of corn were tested. Honey sorghums gave the best returns in forage. The home-grown varieties of corn proved superior to varieties adapted to eastern Kansas.

At the Tribune substation variety tests with sorghums indicate that Dwarf Milo is the highest producer for that section. Experiments with planting corn 84 in. apart instead of 42 in., with the idea of approaching summer fallow conditions but still procuring some return from the soil, gave uniformly higher yields of corn than the closer planting. The home-grown and western-grown varieties gave higher yields than eastern or central Kansas corn.

[Work with field crops at the Belle Fourche reclamation project experiment farm in 1915], B. Aune (*U. S. Dept. Agr., Bur. Plant Indus., Work Belle Fourche Expt. Farm, 1915, pp. 1–11, 15–25, figs. 3*).—Continuing previous work (E. S. R., 33, p. 829), a summary of climatic and general agricultural conditions is given.

In the crop rotation experiments with irrigated field crops, after four years' observations the following indications are noted: Alfalfa shows no marked increase in the yield of the following crops, grains following cultivated crops have given better net returns than when following alfalfa and grain, the application of manure has shown a marked increase in the yield of beets and potatoes but not of grains, beets following grain crops give poor results, and early spring seeding of grains has given higher yields and better quality than late spring seeding.

Three pasture grass mixtures for irrigated lands are being tested. Fall irrigation of annual crops was followed by a decrease of yield.

Experiments with alfalfa have been quite extensive, including investigations as to the proper time and method of seeding and the rate of seeding. Late summer seeding and the use of flax as a nurse crop gave good results. About 10 lbs. of good seed per acre was found to be ample.

A number of grain variety tests were conducted by J. H. Martin. Turkey gave the highest yield of any winter wheat variety, and Kubanka of the spring

wheat sorts. White Russian oats gave the highest yield for the oats, and Chevalier II the highest yield for the barleys. Spring emmer yielded at the rate of 58 bu. per acre. The Russian varieties of flax, C. I. Nos. 3 and 19, gave the highest yield of seed. In variety tests with potatoes the late varieties gave decidedly better results than the early varieties. The variety of corn deemed safest to plant is Northwestern Dent. The most desirable distances for corn seem to be 10, 14, and 17 in. apart in the row.

In an experiment undertaken to determine the best time for breaking dry-land sod, early breaking, April to July, gave the best results for the crop following, with no consistent results after the first year.

[Work with field crops on the Huntley reclamation project experiment farm in 1915], D. Hansen (*U. S. Dept. Agr., Bur. Plant Indus., Work Huntley Expt. Farm, 1915, pp. 1–9, 11–14, 18–21, figs. 3*).—Continuing previous work (E. S. R., 33, p. 429), this bulletin gives a brief outline of the work being conducted on the Huntley reclamation project, including climatic and general agricultural conditions.

The studies on this project are chiefly with irrigated crops. The results of four years' experiments with various crop rotations are reported, the crops used being alfalfa, sugar beets, potatoes, oats, wheat, corn, and flax. The experiments include continuous cropping, and two, three, four, and six year rotations.

In studies with alfalfa to determine the time of harvesting and shrinkage no consistent increase was found from delaying the cutting of the first crop, although the total yield was slightly higher. There was a slight decrease in the amount of shrinkage in the first crop as the growing period was increased, but only a slight variation in the second crop. The average shrinkage on the project during three years has averaged about 76 per cent of the green weight. Some experiments were made in establishing irrigated pastures, a number of grasses being planted separately and in combinations with and without a nurse crop. All the grasses except Kentucky bluegrass gave good results, although further observations are deemed necessary before drawing definite conclusions.

Variety tests included wheat, potatoes, and corn. A preliminary report is given on studies of the losses undergone by sugar beets in the silo.

[Work with field crops on the Scottsbluff reclamation project experiment farm in 1915], F. Knorr (*U. S. Dept. Agr., Bur. Plant Indus., Work Scottsbluff Expt. Farm, 1915, pp. 1–11–13–22, figs. 5*).—This continues previous work (E. S. R., 34, p. 228), and contains a brief discussion of the various projects under way in 1915, with data on weather and crop conditions.

A number of experiments have been undertaken with pasture grasses both when seeded alone and in mixtures. The most promising of the grasses tried are tall oat grass, smooth brome grass, orchard grass, and meadow fescue.

In experiments conducted with crop rotations under irrigated conditions, reported by J. A. Holden, the results to date indicate that there is a decided gain when beets and potatoes follow alfalfa. The yields of both beets and potatoes have also been materially increased by the use of manure. Seeding alfalfa in the fall, after the removal of a small grain crop, has been found feasible.

Variety tests with oats and corn were badly damaged by hail, and no definite conclusions could be drawn. Beloturka yielded highest of the spring wheats and Hannchen of the barleys. Of the stock beets tested Giant Red mangels gave the highest 3-year average yield.

The potato studies included variety tests, seed-stock tests, and irrigation and tillage experiments. In the variety tests No. 4452 and Pearl gave the

highest yields. The seed-stock tests showed immature seed to be distinctly superior for planting. The irrigation and tillage experiments indicated that through a series of years very little difference in yield is to be expected as a result of different methods of irrigation or ditching.

Experiments with sugar beets indicated that deep plowing and deep cultivation are not beneficial to the sugar beet, while they are a source of added expense.

[Work with field crops on the Truckee-Carson reclamation project experiment farm in 1915], F. B. Headley (*U. S. Dept. Agr., Bur. Plant Indus., Work Truckee-Carson Expt. Farm, 1915, pp. 1–10, fig. 1*).—This publication continues previous work (E. S. R., 33, p. 728), giving in addition to a report on experiments in progress a brief summary of weather conditions, a temperature survey of the project, and a statement as to agricultural conditions.

In pasturing hogs on alfalfa, a net gain of $44.04 per acre was realized. Experiments have been conducted with corn, but acclimatized varieties have not yet been developed. In variety tests with wheat Little Club and Dicklow have given the highest yields. A number of varieties of barley were tested, with the Coast variety proving far superior to all others. Golden tankard mangels have given larger yields than the long red mangel.

[Work with field crops on the Yuma reclamation project experiment farm in 1915], R. E. Blair (*U. S. Dept. Agr., Bur. Plant Indus., Work Yuma Expt. Farm, 1915, pp. 1–15, figs. 2*).—This continues previous work (E. S. R., 34, p. 229), including meteorological data and a discussion of the general agricultural conditions.

In work with Durango cotton, it was again found that any check in growth occasioned by drought after the heavy setting of fruit begins is directly reflected in both the yields and the quality of the fiber. A number of varieties of alfalfa were tested but have not been grown a sufficient length of time to give definite results. This was also true of a number of experiments relating to the treatment of alfalfa seed production. Of the 374 strains and varieties of grain sorghums tested, none were found superior to varieties already being grown. Sudan grass has proved to be of value when planted on depleted alfalfa fields or when the hay mixture resulting from such a crop is desired. Sudan grass also furnishes satisfactory pasture when properly irrigated.

A number of miscellaneous forage crops were tested out, among them being forage sorghums, several varieties of millet, flax, and broom corn. Alfalfa showed an increased yield of approximately 2 tons per acre of air-dry hay following a green manure crop.

Cereal experiments on the Cheyenne Experiment Farm, Archer, Wyoming, J. W. Jones (*U. S. Dept. Agr. Bul. 430 (1916), pp. 40, figs. 12*).—This bulletin reports a number of cooperative experiments conducted on the Cheyenne Experiment Farm, Archer, Wyo., since 1912. The results are not given as final but as an indication of what might be expected under similar dry-farming conditions. A detailed description of the territory is given, including a comprehensive discussion of the climatic conditions. The plan of the experiment includes variety tests, rate-of-seeding tests, and date-of-seeding tests.

The following varieties of the principal grain crops are regarded as the most promising for the district: Ghirka and Kharkof winter wheat; Kubanka, Erivan, and Marquis spring wheat; Kherson, Sixty-Day, and Swedish Select oats; White Smyrna and Hannchen spring barley; and Montana Common and Select Russian flax. Neither winter nor spring emmer has proved of value. Foxtail and proso millets have given only low yields, and buckwheat does not appear promising. Grain sorghums and corn are deemed promising forage crops for roughage or silage, but apparently have little or no value as forage crops.

Rate of seeding tests for wheat have not been conclusive. Kherson oats sown at the rate of 6 bu. per acre has yielded better than at lower rates, while Svanhals barley has yielded better at 2 and 3 pk. per acre than at higher rates. For flax, 15 lbs. per acre has given the highest average yields.

Early sowing of winter wheat during the first half of September, has given the highest average yields, and the middle of April for spring common wheat and oats. Svanhals barley has yielded best when sown from the middle to the latter part of April, and flax about June 1.

The effect of different nitrogenous fertilizers, especially guanidin nitrate, on oats and mustard, L. HILTNER (*Prakt. Bl. Pflanzenbau u. Schutz, n. ser., 13* (*1915*), *No. 11–12, pp. 141–155, fig. 1*).—A series of pot experiments were conducted in 1913, 1914, and 1915 with lime nitrate, ammonium sulphate, guanidin nitrate, and urea nitrate as fertilizers for oats and mustard. The results of other investigators in experiments with guanidin nitrate are compared with the data reported in tables and discussed at some length.

In the work described guanidin nitrate in 1913 had an injurious effect on the growth of oats but gave a marked increase in the yield of mustard. The average total results with oats and mustard for 1913 and 1914 were in favor of guanidin nitrate as compared with the other nitrogenous substances. It was further observed that lime nitrate gave a large increase in yield the first year, showing little or no residual effect the second year, while ammonium sulphate did not become active until the second year and guanidin nitrate and urea nitrate gave a much more evenly distributed effect, as indicated by the yields for the two years. The residual effect of the guanidin nitrate in 1914 appeared to be a little above the initial effect of the application in 1913.

The results also showed that where mustard and oats were grown together in the same pot, the mustard was capable of using the nitrogen of the guanidin nitrate, while the oats were not. In experiments carried on in 1915 it was shown that oats grown mixed with mustard did not make use to the fullest advantage of the nitrogen supplied by the four different forms, while when grown alone they made good use of the supply of nitrogen from all sources except the guanidin nitrate. In view of these results the relation between the growth of wild mustard and oats in the open field is considered.

Anomalous endosperm development in maize and the problem of bud sports, R. A. EMERSON (*Ztschr. Induktive Abstam. u. Vererbungslehre, 14* (*1915*), *No. 5, pp. 241–259, fig. 1*).—Two anomalous seeds of maize from a cross between colorless parents, one homozygous starchy and the other sugary, are described. One seed, starchy throughout, was about half colorless and half colored purple, while the other, colored purple throughout, presented an endosperm part starchy and part sugary. A description is also given of a third anomalous seed from a cross between colorless seeded and heterozygous, colored-seeded parents, the seed being wholly colored, but half purple and half red.

These seeds are regarded as inexplicable on the hypothesis that the second male nucleus and the fused polar nuclei may each independently develop a part of the endosperm, or on the alternative hypothesis that the second male nucleus may unite with one polar nucleus to produce part of the endosperm, the other polar nucleus developing independently to produce the other part. The seeds are considered explainable on the basis of the hypothesis that subsequent to normal endosperm fertilization there occurs a vegetative segregation of genetic parentage. It is believed to have been shown that if such a segregation occurs it is not a typical Mendelian segregation, as in neither of the three cases all the independently inherited genetic factors present in a heterozygous condition could have been involved. It is suggested that such seeds

may also be regarded as due to a change in genetic constitution rather than to a segregation of genetic factors.

A fourth anomalous maize seed with a small part colored and waxy and the remainder white and horny, which was described by Collins, is regarded as being explainable on the basis of either of the four hypotheses. It is considered of special interest in connection with the segregation and mutation hypotheses because, as is stated, at least two factors instead of a single one are concerned.

The relation of such somatic segregations and mutations in the endosperm of maize to bud sports is considered. Reasons are given for the belief that in certain cases the production of self-color as a bud sport in variegated plants is to be regarded as a somatic mutation rather than as a somatic segregation. The importance of a genetic analysis of material in which bud sports occur, particularly the recessive bud sports, in order to determine whether the factors concerned are in a heterozygous or homozygous condition is pointed out.

Eighteen citations to literature on the subject are appended.

Yields of different varieties of corn in Illinois, W. L. Burlison and O. M. Allyn (*Illinois Sta. Bul. 191 (1916), pp. 408–424*).—This bulletin reports results of variety tests of corn in Illinois. The highest yielding varieties for the northern, central, and southern sections of Illinois, respectively, were Western Plowman, Reid Yellow Dent, and Funk Ninety Day. A brief history of some of the varieties tested is included in the report.

Variety tests of corn, C. B. Hutchison, A. R. Evans, J. C. Hackleman, and E. M. McDonald (*Missouri Sta. Bul. 143 (1916), pp. 56, figs. 15*).—This bulletin reports the results of variety tests of corn for the 10-year period from 1905–1914, and is supplementary to Bulletin 87 (E. S. R., 23, p. 436). A number of varieties of corn have been tested at the station and from them the more promising varieties chosen for further testing in cooperative experiments throughout the State. The history and description of 12 varieties of corn is given, together with illustrations of each variety. The tests were conducted on seven distinct soil areas, which are described in detail and designated as follows: (1) Black prairie, (2) rolling prairie, (3) level prairie, (4) gray prairie, (5) Ozark border, (6) Ozark uplands, and (7) Missouri lowlands.

The variety tests at Columbia for the 10-year period showed as the leading varieties of white corn Commercial White, Boone County White, Johnson County White, and St. Charles White. The leading varieties of yellow corn were Reid Yellow Dent, Leaming, Cartner, and St. Charles Yellow. The leading varieties for each soil area named above were as follows: (1) and (2), Commercial White and Reid Yellow Dent, (3), (4), and (5), Commercial White and Boone County White, (6), Commercial White and St. Charles White, and (7), Commercial White and Boone County White, except in southeast Missouri, where St. Charles stood first and Boone County White second, and in north Missouri, where Commercial White stood first and St. Charles White second.

Study of the root system of flax, A. P. Modestov (*Trudy Opytn. Sta. Moskov. Selsk. Khoz. Inst., No. 1 (1915), pp. 67–84, figs. 11*).—The study of the root systems of a number of pure lines showed that long-stemmed flax as compared with other varieties appeared to have a weaker root system and a more limited root penetration. Of the different soils used in the studies peat stood first and sandy soil second in suitability for root development. A better root growth was developed by means of water culture than in clay or clay soil. With 30 per cent of moisture in the soil, the lowest moisture content in the experiment, the aerial portions of the plants developed best and the roots least, while with

90 per cent, the greatest amount of moisture used, the aerial portions showed the smallest and the roots the largest growth. Under field conditions, the flax being drilled, the roots were found to extend into the soil to a depth of about 20 cm. (7.4 in.) when the plants had from 10 to 12 leaves, of 52 cm. when in bloom, and of 65 cm. when the blossoming period had ended. Deep planting of the seed affected root development adversely.

[The effect of freezing on flax seed], I. SHULOV and V. MOROZOV (*Trudy Opytn. Sta. Moskov. Selsk. Khoz. Inst., No. 1 (1915), pp. 42–66, figs. 16*).—Air-dry seed of flax exposed for one month to a temperature never above −2° R. (27.5° F.) showed no signs of deterioration, while similar seed moistened until swelled suffered a reduced germination through freezing. The results of pot experiments indicated the value of a high moisture content in sandy soil during the early growth of flax.

Changes in specific gravity in their bearing on the starch and dry matter content of potato tubers during the rest period, L. SZÉLL (*Kisérlet. Közlem., 18 (1915), No. 5–6, pp. 1020–1029*).—Tubers of Richter-Imperator and Up-to-date were stored in a cellar and in a pit out-of-doors. The lot stored in the cellar was examined every two weeks with reference to specific gravity and starch and dry matter content, while the other lot was so examined only at the beginning and close of the storage period.

The specific gravity and relative starch and dry matter value increased in general during the rest period in both varieties of the cellar-stored lot, but decreased in the tubers stored in the out-door pit. The increase in specific gravity followed no definite regularity, which is regarded as due in the first place to such factors as condition of health, respiration, sprouting stage, moisture, temperature, etc., and in the second place to the sources of error in determining specific gravity such as size, shape, degree of maturity, hollowness, of tubers, skin structure, depth of buds, adhesiveness of water to the surface of the tubers, inaccuracies in the method employed, etc., all of which are of irregular influence. Richter-Imperator exhibited a marked tendency to rot, and showed a much greater difference between maximum and minimum specific gravity during the rest period than did Up-to-date. The author does not believe that the methods of determining the specific gravity of potato tubers now employed on farms give reliable results.

[**Variety tests with potatoes**], E. F. GASKILL (*Massachusetts Sta. Rpt. 1915, pt. 1, pp. 44a, 45a*).—The yields of seven early and eleven late varieties of potatoes are reported. Among the early varieties Early Surprise led with a yield of 314.8 bu. per acre, being followed by Trust Buster with 289.7 bu. Both of these varieties ranked among the five best yielders in all of the three preceding years. The largest yield of the late varieties, 374.5 bu. per acre, was secured from Farmer, with Quick Crop ranking next with 371.3 bu. The late varieties averaged the higher in yield.

Commercial handling, grading, and marketing of potatoes, C. T. MORE and C. R. DORLAND (*U. S. Dept. Agr., Farmers' Bul. 753 (1916), pp. 40, pl. 1, figs. 18*).—This deals with the problems of handling and marketing potato crops, and is meant to be of special interest to commercial growers and shippers. The methods employed in handling the southern early or "new" potatoes and the northern late potatoes are discussed in detail. The use of machine potato diggers and the machine sizing of potatoes are discussed, and the necessity for the establishment and maintenance of definite standards is pointed out. Cooperative marketing organizations are recommended as a means of securing a standardization of the product. Growers are urged to study market conditions and to give careful attention to shipping details. Middlemen are urged to buy potatoes strictly on their merits, thus encouraging careful grading.

The possibilities of sugar beet culture in Washington, I. D. CARDIFF (*Washington Sta. Popular Bul. 105 (1916), pp. 3–8*).—This bulletin is a brief discussion of the sugar beet in Washington, based on studies previously reported (E. S. R., 6, p. 543; 7, p. 762; 9, p. 240; 10, p. 545). Experiments in the Yakima Valley are cited showing that beets can be produced in Washington which test from 15.5 to 17.6 per cent of sugar in the juice and 16.7 per cent in the beet, with an average purity of 85.2 per cent. The value of the sugar beet as a soil cleansing crop is pointed out, together with its adaptability to alkali conditions.

Experiments with Marquis wheat, C. R. BALL and J. A. CLARK (*U. S. Dept. Agr. Bul. 400 (1916), pp. 40, figs. 10*).—This bulletin gives a brief history and description of Marquis wheat, and reports the results of experiments in 13 different States, representing a wide range in soil and climatic conditions, and grouped as follows: (1) The northern Prairie States, or subhumid section; (2) the northern Great Plains States, or semiarid section; (3) the Basin and Coast, or arid areas; and (4) the irrigated districts of the northern Rocky Mountain region and Great Basin areas. The experiments in each section are discussed in detail and the comparative yields tabulated and discussed.

In the northern Prairie States the facts were brought out that where hard red winter wheats of the Crimean group can be grown they outyield any spring wheat varieties, but that Marquis wheat outyields all other spring wheat varieties in that section. The results in the northern Great Plains area show that where winter wheat can be grown it outyields any spring wheat. Among the spring wheats tested the durums outyielded all other groups, although Marquis was superior to all the common spring wheats. In the Basin and Coast areas Marquis wheat did not prove a high yielder, and can not be recommended for any district west of the Rocky Mountains. Under irrigation Marquis has not proved to be a good yielder except in limited experiments east of the Rockies. It is reported as being a first-class milling wheat.

HORTICULTURE.

Encyclopedia of horticulture, compiled by A. PUCCI (*Encyclopedia Orticola. Turin: Il Giardinaggio [1910–1916], vols. 1–4, pp. 1684, figs. 2007*).—A compiled work comprising a complete illustrated dictionary of all the ornamental, flowering, and economic plants, cultivated or adapted for culture in the gardens of Italy, including also directions for culture, methods of propagation, uses, and illustrated descriptions of all garden equipment, tools, and accessories.

[Horticultural investigations on the Yuma Reclamation Project in 1915], R. E. BLAIR (*U. S. Dept. Agr., Bur. Plant Indus., Work Yuma Expt. Farm, 1915, pp. 15–27, figs. 5*).—A progress report, continuing previous work (E. S. R., 34, p. 231) on cultural and variety tests of orchard and small fruits, vegetables, and ornamentals, including cultural suggestions and recommendations as to varieties based upon experiments conducted on the project.

[Experiments with vegetables on the Truckee-Carson Reclamation Project], F. B. HEADLEY (*U. S. Dept. Agr., Bur. Plant Indus., Work Truckee-Carson Expt. Farm, 1915, pp. 10–12*).—Continuing previous work (E. S. R., 33, p. 735), the results are given of variety tests of tomatoes and onions and a fertilizer test with onions.

Manual for the raising of garden seed, L. DÆHNFELDT (*Vejledning i Havefröavl. Odense: Poul Söndergaards, 1916, pp. 84*).—A treatise on vegetable growing with special reference to seed production.

[Report of] the asparagus substation, Concord, W. P. BROOKS (*Massachusetts Sta. Rpt. 1915, pt. 1, pp. 16a–22a*).—Investigations leading to the breeding

of a rust-proof asparagus that have been conducted for several years by J. B. Norton (E. S. R., 26, p. 44) indicate that a number of strains of asparagus have been developed which possess both excellent commercial characteristics and in very high degree the capacity to resist attacks of rust. Roots and seeds of these strains are being tested by different growers.

A brief account, together with a summary of results and conclusions, is given of fertilizer experiments with asparagus, C. W. Prescott in charge. A study of the yields and conditions affecting all the fertilizer plats leads to the conclusion that the application of nitrate of soda results in a large increase in the crop. On the light soils where the experiments were conducted nitrate of soda at the rate of 450 lbs. per acre appears to give a more profitable increase in crop, when used in connection with materials supplying abundant potash and phosphoric acid in available forms, than where a larger quantity is used. No definite results have been secured thus far relative to the best season to apply nitrate of soda when used in connection with fertilizers supplying phosphoric acid and potash.

In the experiments in question acid phosphate at the rate of 450 lbs. per acre and muriate of potash at the rate of 262 lbs. per acre have given the best results in combination with nitrate of soda. Muriate of potash appears to be the best source of potash for the asparagus grower. Although rust has not been prevalent during the past three years, observations made by two different observers working independently indicate that the application of nitrate of soda at the close of the cutting season promotes a vigorous growth and seems to increase the capacity of the foliage to resist rust. This appears to be true whether the nitrate is applied one-half in the early spring and the balance at the close of the cutting season or all at the close of the cutting season.

De Vriesian mutation in the garden bean, Phaseolus vulgaris, J. A. Harris (*Proc. Nat. Acad. Sci., 2* (*1916*), *No. 6, pp. 317, 318*).—In this note the author describes a race of beans now under cultivation at the Station for Experimental Evolution, Cold Spring Harbor, N. Y., in which the whole morphological organization of the seedling has apparently been changed. The new race is also characterized by a high degree of variability. The origin of this race is attributed to de Vriesian mutation (E. S. R., 22, p. 625).

Marketing and distribution of western muskmelons in 1915, O. W. Schleussner and C. W. Kitchin (*U. S. Dept. Agr. Bul. 401* (*1916*), *pp. 38, fig. 1*).—In connection with a general study relative to the grading, packing, and marketing of cantaloups (E. S. R., 34, pp. 340, 737) a more detailed study was made of marketing conditions in the irrigated districts of the West. The results of this study are given in the present bulletin. Each region is considered in connection with the history of the industry, marketing arrangements, possibilities of cooperation, and quality and distribution of the crop. Charts are also given showing the distribution of western muskmelons in all markets in 1915, together with net returns to the growers.

The melons on the market in Paris, J. M. Buisson (*Compt. Rend. Acad. Agr. France, 2* (*1916*), *No. 32, pp. 940–945*).—The varieties of melons cultivated in the south of France are described.

[Some results of horticultural investigations] (*California Sta. Rpt. 1916, pp. 44–46, 47, 58, 59, 61*).—A brief statement is given of some of the results of horticultural investigations at the station that have a more or less direct bearing on the horticultural industries of the State.

Studies of the oil content of avocados conducted by M. E. Jaffa emphasize the desirability of allowing the fruit to become as mature as possible before marketing in order to increase the fat content. The fat content at maturity varied from a maximum of 27 per cent to a minimum of 5 per cent, thus show-

ing the importance of selection as to variety if the percentage of oil is to be taken into consideration. Demonstrations made by Coit show that the Babcock test may be used for the determination of fat in avocados with sufficient accuracy for a preliminary comparison of the value of seedlings.

Preliminary examinations by Jaffa of olives labeled "ripe olives" show a variation in the fat content much greater than can be ascribed to the difference in varieties or to the loss of oil in the pickling process. The wide range is considered to be largely due to the processing and marketing of immature olives in place of ripe olives.

The more important practical results secured from grape investigations conducted by F. T. Bioletti are summarized. The plum and prune pollination investigations carried on by A. H. Hendrickson show definitely that all varieties of the Japanese prune or plum (*Prunus triflora*) are self-sterile, with the possible exception of the Climax. The varieties of this group seem to cross-pollinate readily. Of the European varieties of plum, *P. domestica*, Tragedy, and Clyman show distinct evidence of self-sterility. Of the prunes, French and Sugar prunes appear to be self-sterile to some extent. Robe de Sergeant and Imperial prunes are distinctly self-sterile. Imperial, French, and Sugar prunes seem to cross-pollinate satisfactorily.

In similar observations on almonds made by W. P. Tufts during 1916 13 varieties, including practically all grown on a commercial scale in California, proved to be wholly self-sterile under conditions existing at the University Farm. Two of the leading varieties, Nonpareil and I X L, were found to be intersterile as well as self-sterile. Ne Plus Ultra was satisfactory as an interpollenizer with both I X L and Nonpareil.

The leading commercial varieties of cherries grown in the State, including Napoleon, Lambert, Bing, Black Tartarian, and Black Republican, were found to be self-sterile. There is distinct evidence of intersterility between several varieties, such as Bing and Napoleon. The best pollenizers for cherries in the State have not been worked out thus far.

Preliminary investigations conducted by W. L. Howard and Tufts indicate that fruit bud formation under interior valley conditions, at least in California, occurs from one to two months later than in other sections of the United States where studies of this phase of fruit production have been made.

Observations on the varieties of pecans planted in California indicate that the season is too short for pecan culture in the northern and middle coastal regions. In the interior valleys and in the southern coast counties many pecans have been found to ripen their crops without difficulty. Many other pecan seedlings failed to mature their crops in the southern coast counties.

A study of the Weather Bureau records in various parts of California by A. E. Way for determination of maturity of oranges have led him to conclude that the factor that chiefly affects maturity is not soil type, irrigation, fertilization, heat, or light units alone but the ratio between the total heat units and relative humidity of the atmosphere.

A paper on the results of experiments in fertilizing citrus groves has been noted from another source (E. S. R., 35, p. 448). The experiments in using winter cover crops as green manures in citrus groves continue to emphasize the importance of this practice in citrus culture (E. S. R., 33, p. 642). The use of bitter clover (*Melilotus indica*), advocated by the station as a result of these experiments, is becoming very general. The experimental plats on the station grounds show marked increases in vigor and yield where green manures have been used.

In a preliminary study of a seedling Santa Barbara soft-shell walnut grove being conducted by L. D. Batchelor wide variation was found to exist with reference to production of the trees, their susceptibility to blight, size, season of leafing out in the spring, and the season at which the trees become dormant in the fall. Trees which retain their leaves late in the fall are better producers than those which drop their leaves early. Very little relationship occurs between the season of foliation in the spring and the crop production. Likewise little or no relationship exists between the prevalence of blight and either the season of dormancy or the season of foliation. The size and vigor of the tree does not appear to influence the prevalence of the blight. There is a marked correlation between the size of the tree and its production. In cooperation with the walnut growers selections have been made of 16 promising seedling trees scattered about the State that are known to be specially heavy producers and more resistant to blight than the average.

[Orchard trees and small fruits on the Huntley Reclamation Project], D. Hansen (*U. S. Dept. Agr., Bur. Plant Indus., Work Huntley Expt. Farm, 1915, p. 22*).—A brief statement relative to variety tests of orchard trees and small fruits being conducted on the project and continuing previous work (E. S. R., 33, p. 429).

Modern propagation of tree fruits, B. S. Brown (*New York: John Wiley & Sons, Inc., 1916, pp. XI+174, figs. 75*).—A treatise on the propagation of fruit trees, in which are considered those practices of propagation which are accepted as the most important by the orchardist and commercial nurseryman. The subject matter is presented under the general headings of seed for propagation, growing the seedlings, the nursery, budding operations, grafting operations, propagation by cuttings, the after treatment of nursery stock, and some general considerations.

Some figures on the cost of bringing orchards into bearing (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 10, pp. 368–371*).—Records are submitted by a number of growers in California showing the cost of bringing orchards of different kinds of fruits and of different sizes into bearing.

Some improvements in the packing and transport of fruit in India, A. and Gabrielle L. C. Howard (*Fruit Expt. Sta. Quetta Bul. 2 (1915), pp. 21, figs. 6*).—This paper discusses briefly the present methods of packing and transporting fruit in India and calls attention to some of the improvements that can be made along this line as developed with experiments conducted at Pusa and Quetta.

Notes on Pomaceæ of upper South Carolina, W. W. Ashe (*Bul. Charleston Mus., 12 (1916), No. 5, pp. 37–43*).—The author describes species of crab apples and hawthornes observed in upper South Carolina. A number of new species are included.

The pollination of the pomaceous fruits.—III, Gross vascular anatomy of the apple, E. J. Kraus and G. S. Ralston (*Oregon Sta. Bul. 138 (1916), pp. 4–12, pls. 8*).—This is the third of a series dealing with the pollination of pomaceous fruits (E. S. R., 33, p. 838).

In the present paper the authors discuss and illustrate the anatomy of the pedicel, toral, and carpellary systems of the apple as observed in a study of the Yellow Newtown variety.

The fruiting of trees in consecutive seasons, S. Pickering (*Jour. Agr. Sci. [England], 8 (1916), No. 1, pp. 131–135*).—A popular review of the results secured in the investigations at the Woburn Experimental Fruit Farm (E. S. R., 35, p. 37).

Peach growing in Ontario, F. M. Clement and A. G. Harris (*Ontario Dept. Agr. Bul. 241 (1916), pp. 51, figs. 48*).—An account of peach growing in Ontario,

including the history of the industry, varieties, culture, harvesting, and marketing. A paper on the More Important Insects and Diseases Attacking Peach Trees (pp. 41–51), by L. Caesar and J. E. Howitt, is also included.

The persimmon in California, S. Fujii (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 10, pp. 362–367, figs. 7*).—A number of Japanese persimmons adapted for culture in California are described.

State bog report, H. J. Franklin (*Ann. Rpt. Cape Cod Cranberry Growers' Assoc., 28 (1915), pp. 13–32*).—A report on the work at the Massachusetts state cranberry bog for the year 1915, the substance of which has been noted from another source (E. S. R., 36, pp. 43, 51, 54).

Is the hybrid origin of the loganberry a myth? (*Jour. Heredity, 7 (1916), No. 11, pp. 504–507, fig. 1*).—In this article some evidence is presented to show that the loganberry has behaved on the whole as a true species rather than as a hybrid of the blackberry and raspberry.

Methods of reproducing grapes by long cuttings and short cuttings, P. J. Ricome (*Los Procedimientos de Reproduccion de la Vid, Estacas Largas y Estacas Cortas. Lima, Peru: Govt., 1916, pp. 26, pls. 4*).—The author gives the results of two years' experiments in reproducing grapes. Briefly summarized the use of one-year cuttings completely covered in the ground gave the best results in coastal Peru.

Some recent operations and experiments with bud variations, A. D. Shamel (*Cal. Citrogr., 2 (1916), No. 1, pp. 14–16, figs. 3*).—Essentially noted from other sources (E. S. R., 34, p. 639).

Pruning the Washington navel orange, R. W. Hodgson (*Univ. Cal. Jour. Agr., 4 (1916), No. 2, pp. 38–40, figs. 4*).—Observations are presented on methods of pruning Washington navel oranges, based upon the results of four seasons' actual pruning and a study of the various pruning systems practiced by growers.

Report on manurial experiments (*Imp. Dept. Agr. West Indies, Rpt. Agr. Dept. Dominica, 1915–16, pp. 14–28*).—A progress report on manurial experiments with cacao and limes in Dominica (E. S. R., 34, p. 438). The work with limes continues to show satisfactory growth, accompanied by a substantial increase in profit, on the complete manure plat as well as a slow but steady improvement in the yield and general appearance of trees on the mulch plat. The work with cacao continues to show a decided advantage over fertilizers in favor of the mulch plats.

[Cacao experiments, 1914–15], J. de Verteuil (*Bul. Dept. Agr. Trinidad and Tobago, 15 (1916), No. 4, pp. 111–142, pls. 9*).—This is the usual progress report for the year ended August 31, 1915, relative to manurial, shade, pruning, and natural yield experiments being conducted in a number of plantations in Trinidad (E. S. R., 33, p. 738), including also data on manurial experiments with cacao and rubber in Tobago. No conclusions have thus far been drawn from the work as a whole. With reference to natural yield experiments it has been observed, generally speaking, that the heavy bearing trees of the first year have continued to be heavy bearers, and that the poor-yielding trees have remained poor during subsequent years.

Cacao, J. E. van der Laat (*Pub. Dept. Agr. Costa Rica No. 4 (1916), pp. 23*).—A practical treatise on the culture and preparation of cacao for market.

[Experiments with coffee in Surinam], E. van Drent (*Dept. Landb. Suriname Verslag, 1915, pp. 50–61*).—The various species of coffee being tested at the Government Culture Garden are listed, and data are given on the yields during 1915 of the various trees of Uganda, Canephora, Quillou, and Excelsa coffee being tested.

The cultivation and preparation of coffee for the market, J. P. UGARTE (*1916, 2. ed., pp. 101, pls. 19, figs. 2*).—This work comprises a description of the various operations in connection with coffee planting and culture; information relative to methods of coffee pulping, fermenting, washing, drying, hulling, polishing, and grading, as well as general remarks based on practical experience acquired in Mexico, Central America, etc.

New and successful method of rooting date palm offshoots, J. E. COIT (*Univ. Cal. Jour. Agr., 4 (1916), No. 2, pp. 49, 60, 61, figs. 2*).—The author here describes a method of rooting date palm offshoots developed by B. Drummond of the Bureau of Plant Industry of the U. S. Department of Agriculture in cooperation with J. Northrop of Indio, Cal.

The method consists essentially in the use of a propagating house covered with canvas instead of glass and with no ventilation whatever. This type of house was found to be much more economical than a glass house and has yielded satisfactory results to a number of growers. It prevents excessive drying by wind and sun, maintains an atmosphere of rather dense humidity above the plants, and at the same time a high temperature, thus furnishing the best conditions for rooting date palm offshoots. In some instances many old offshoots which had been set in the field for one or even two years and had shown no signs of life have, when placed in the canvas houses, thrown out large fresh green leaves and vigorous roots within six or eight weeks.

Colonial plants—Perfume, tincture, and tannin plants, and tobacco, H. JUMELLE (*Les Cultures Coloniales—Plantes a Perfums, a Colorants, et a Tannins, Tabac. Paris: J. B. Baillière & Sons, 1916, 2. rev. ed., vol. 8, pp. 112, figs. 25*).—This is part 8 of the author's revised work (E. S. R., 34, p. 838). The present part discusses the various perfume, tincture, and tannin plants and tobacco with reference to their botany, exploitation, culture, and utilization.

Colonial plants.—Industrial plants, H. JUMELLE (*Les Cultures Coloniales—Plantes Industrielles. Paris: J. B. Baillière & Sons, 1916, rev. and enl. ed., pp. 112+118+119+112+XX, figs. 146*).—The present volume comprises parts 5 to 8 of the author's work on colonial plants which have previously been issued separately (see above abstract). The plants included are oil-yielding plants, textile plants, and plants yielding rubber, caoutchouc, lac, perfumes, tinctures, and tannins, and tobacco.

Sources of supply of hazelnuts (*Bul. Imp. Inst. [So. Kensington], 14 (1916), No. 2, pp. 261–267*).—A short statistical account relative to the production and supply of hazelnuts in different countries.

Iris breeding (*Jour. Heredity, 7 (1916), No. 11, pp. 502, 503*).—This paper includes a contribution by Grace Sturtevant on the technique of iris breeding, together with some descriptive notes on iris hybrids secured in breeding work conducted by W. R. Dykes and by S. Mottet.

My garden, LOUISE B. WILDER (*Garden City, N. Y.: Doubleday, Page & Co., 1916, pp. XIX+308, pls. 8*).—An account of the author's experience in planning and making an ornamental garden, including descriptive notes on the various plantings as they appear throughout the season, information relative to methods of propagation, culture, and care, the adaptation of plants to different situations, and the merits of different varieties. Lists are given of the best annuals and of plants for special situations, the wild garden, herb garden, and wall garden, and references are made to a number of works dealing with gardens and plant material.

My garden in spring, E. A. BOWLES (*London: T. C. & E. C. Jack, 1914, pp. XX+308, pls. 40*).—This is the first of a series of three books, edited by R. H. Pearson, which is primarily descriptive of the plant material in the author's

garden in Middlesex, England. The present volume deals with the several parts of the garden in their spring aspects.

My garden in summer, E. A. Bowles (*London: T. C. & E. C. Jack, 1914, pp. VIII+316, pls. 40*).—A work similar to the above, descriptive of the author's garden in its summer aspects.

My garden in autumn and winter, E. A. Bowles (*London: T. C. & E. C. Jack, 1915, pp. VIII+272, pls. 40*).—A work similar to the above, descriptive of the author's garden in its autumn and winter aspects.

Beautifying the rural home, C. N. Keyser and E. G. Welch (*Ga. State Col. Agr. Circ. 30 (1916), pp. 8, figs. 8*).—This circular contains pictures and plans of a model farmstead of 2.25 acres and a model town lot of 0.9 acre in extent.

FORESTRY.

British forestry, E. P. Stebbing (*London: John Murray, 1916, pp. XXV+257, pls. 13*).—An economic discussion of the present status and future outlook of forestry in Great Britain. The subject matter is presented under the general headings of a national planting scheme, British timber supplies and the forests of Russia, timber supplies and the war, and the employment of women in forestry.

Forest problems and economic development in South America, R. Zon (*Proc. Soc. Amer. Foresters, 11 (1916), No. 4, pp. 375–385*).—A paper on this subject read before the Second Pan-American Scientific Congress, at Washington, D. C., January 5, 1916 (E. S. R., 34, p. 306).

South American forests, H. M. Curran (*Proc. Soc. Amer. Foresters, 11 (1916), No. 4, pp. 369–374*).—A short general description of the principal forest types of South America.

[Trees and shrubs on the Belle Fourche Reclamation Project], B. Aune (*U. S. Dept. Agr., Bur. Plant Indus., Work Belle Fourche Expt. Farm, 1915, pp. 25, 26, fig. 1*).—A brief statement relative to the condition of trees and shrubs under test on the Belle Fourche Experiment Farm in 1915 and continuing previous work (E. S. R., 33, p. 837).

The tests indicate that for a quick-growing windbreak Carolina and Norway poplars are probably the best. It is recommended that these be planted in alternate rows with green ash, white elm, and honey locust, the windbreak to be finished on each side with Russian oleaster and Siberian pea tree. A list is also given of shrubs for ornamental planting that seem to be suitable for local conditions and climate.

Tree distribution under the Kinkaid Act, 1911 (*U. S. Dept. Agr., Forest Serv., Tree Distribution Under Kinkaid Act, 1916, rev. ed., pp. 13, figs. 6*).—This publication explains the provision for the free distribution of young trees in western Nebraska from the Nebraska National Forest, as annually provided for in the Federal agricultural appropriation act; briefly discusses the characteristics of trees considered suitable for planting; and gives illustrated directions for growing and planting the trees, together with instructions for securing trees for planting.

Forest Service silviculture plans, T. S. Woolsey, Jr. (*Proc. Soc. Amer. Foresters, 11 (1916), No. 1, pp. 1–16*).—In this article the author comments in detail on the silviculture section of the Forest Service working plans and offers suggestions relative to the development of working plans.

Notes on forest cover and snow retention on the east slope of the Front Range in Colorado, N. deW. Betts (*Proc. Soc. Amer. Foresters, 11 (1916), No. 1, pp. 27–32, figs. 4*).—The author presents some data on results of observations made in Colorado during 1911 and 1912 with the view of calling attention to

the effect of the spruce type of forest in retaining the snow at high altitudes. It is further pointed out that the advantage of the treeless catch basins lying above the timber line for the formation and retention of large snow drifts is due, not to the fact that they are treeless, but to their location in regard to precipitation, wind, and summer climate. The part that the present stands of spruce play in keeping the snow as high as possible is the important point, and has a direct bearing on the value of reforesting the many burned areas in the high mountains at the head of streams.

Evaporation and soil moisture in relation to plant succession, C. F. Korstain (*Proc. Soc. Amer. Foresters, 11* (*1916*), *No. 4, pp. 430–433*).—A review of some literature on the subject.

Silvical notes on western larch, J. A. Larsen (*Proc. Soc. Amer. Foresters, 11* (*1916*), *No. 4, pp. 434–440*).—Notes on the growth performance of western larch in mixed stands and its adaptation to different sites and soils.

Slash pine, an important second-growth tree, W. R. Mattoon (*Proc. Soc. Amer. Foresters, 11* (*1916*), *No. 4, pp. 405–416, fig. 1*).—An account of the slash pine (*Pinus caribæa*) with reference to its present range of distribution, factors of local distribution, important silvicultural characteristics, value of lumber, and production of turpentine.

The natural root grafting of conifers, H. S. Newins (*Proc. Soc. Amer. Foresters, 11* (*1916*), *No. 4, pp. 394–404, figs. 6*).—Studies conducted by the author relative to the natural root grafting of conifers led to the conclusion that this phenomenon is common only between trees having an affinity for each other, and is due moreover to pressure exerted by two or more opposing roots in combination with a number of physical factors. The phenomenon of the "growing stump" as observed among conifers is most common with Douglas fir and is the result of conjunctive symbiosis which is made possible by the natural root graft of the stump with a living tree.

Chemistry as an aid in the identification of species, A. W. Schorger (*Proc. Soc. Amer. Foresters, 11* (*1916*), *No. 1, pp. 33–39*).—The author cites authorities to show that although the oil from the same species may differ in quantity in different localities, the quality remains identical. The results are also given of an examination of the volatile oils from a number of western species of pine, with particular reference to distinguishing between Jeffrey pine, western yellow pine, and "cross variety" western yellow pine, which species are usually hard to distinguish between in the field.

"The data obtained by chemical analyses have shown that 'cross variety' western yellow pine should be referred to *Pinus ponderosa* and that there is no relation between 'cross variety' pine and *P. jeffreyi*. There are also indications of the occurrence in California of typical specimens of *P. ponderosa scopulorum*. The oils from *P. ponderosa* and *P. ponderosa scopulorum* are distinctly different and justify the separation into two forms. Oils from western yellow pine from Arizona and Colorado agree closely, while oils examined from the State of Washington agree with the typical oils from *P. ponderosa* of California, showing that the defined difference in geographical distribution of the species and its variety is supported by a difference in the composition of the oils."

Comparative test of the Klaussner and Forest Service standard hypsometers, D. K. Noyes (*Proc. Soc. Amer. Foresters, 11* (*1916*), *No. 4, pp. 417–424*).—The test here noted was conducted on a number of permanent sample plats established by the Forest Service of the U. S. Department of Agriculture in California.

The results in general showed that the Klaussner hypsometer is only from 60 to 80 per cent as fast as the Forest Service hypsometer, depending on the size

of the timber encountered. Nevertheless, because of other advantages here discussed the Klaussner hypsometer was adopted for work on the project.

Utilization and round-edge lumber, R. T. Fisher (*Proc. Soc. Amer. Foresters, 11 (1916), No. 4, pp. 386–393*).—An account of the close utilization of saw timber in the woodlot region of central New England.

The utilization of a tropical forest, G. P. Ahern (*Proc. Soc. Amer. Foresters, 11 (1916), No. 1, pp. 17–26*).—A paper on this subject delivered before the Society of American Foresters, December 16, 1915.

DISEASES OF PLANTS.

Department of botany, A. V. Osmun (*Massachusetts Sta. Rpt. 1915, pt. 1, pp. 62a–64a*).—A brief account is given of investigations of plant diseases during the year covered by this administrative report.

The mosaic disease of sweet peas, ring spot of cauliflower caused by *Mycosphærella brassicæcola*, and a leaf spot of digitalis due to an undetermined species of Colletotrichum are reported as not having been previously observed in the State. Notes are also given on the silver scurf, late blight, and Rhizoctonia disease of potatoes, together with reports of diseases of a number of other economic plants. The damage done by the late blight is said to have been especially heavy, but it was noticed that those fields repeatedly sprayed with Bordeaux mixture showed little loss.

Some culture experiments on the production of powdery scab of potato were conducted in which plantings of infected tubers were made on the station plats and on soil from these plats sent to Maine. No evidence of the powdery scab was obtained from the station plantings, but the disease did develop on the soil sent to Maine. The results are thought to indicate that climate plays an important part in the distribution of this disease.

Heavy losses to tobacco growers in the Connecticut Valley were reported as resulting from some obscure troubles which are not yet determined but which are believed to be related in some way to the nutrition of the plants.

The white pine blister rust is said to occur in 8 of the 14 counties of the State, and it has assumed serious proportions in western Massachusetts. Investigations of certain phases of the life history of the fungus with a view to obtaining control have been inaugurated.

Five undescribed species of Ravenelia, W. H. Long (*Bot. Gaz., 61 (1916), No. 5, pp. 417–424*).—The author describes as new species *R. rœmerianæ* on *Acacia rœmeriana* at San Marcos, Tex.; *R. morongiæ* on *Morongia uncinata* at Austin, Tex.; *R. thornberiana* on *A. constricta paucispina* at El Paso, Tex.; *R. reticulatæ* on *Calliandra reticulata* at Divide, Ariz.; and *R. annulata* on *Lysiloma latisiliqua* at Miami, Fla.

Rhizoctonia solani in relation to the "Mopopilz" and the "Vermehrungspilz," B. M. Duggar (*Ann. Missouri Bot. Gard., 3 (1916), No. 1, pp. 1–10*).—The author considers it safe to conclude that the seed bed fungus common in Germany and France is identical with the damping-off fungus which has been studied in this country since 1892, some contributions regarding which are discussed. Evidence is offered in favor of the view that this fungus is identical with that which causes the mopo disease of cinchona ascribed by Rant to *Moniliopsis aderholdii* (E. S. R., 34, p. 749) and herein asserted to be the same as *R. solani*.

Cereal disease resistance (*Kansas Sta. Rpt. 1915, p. 15*).—Attention is called to a method devised by this station to secure under field conditions the infection of various cereals.

In connection with studies of disease resistance, a variety of emmer has been found which is not subject to rust attack, while another was only slightly attacked. A number of F_1 and F_2 generations of wheat hybrids are being tested for resistance to rust (*Puccinia graminis tritici*). Observations made on 119 varieties of winter wheat showed infection with leaf rust (*P. rubigo-vera tritici*) varying from 5 to 90 per cent. Histological studies are said to be in progress to determine the cause of immunity to smut in milo maize and of susceptibility to this smut in other sorghums. Studies are being conducted on the life habits of the smut on maize and on the varietal resistance due to environmental conditions or to specific characteristics in the host.

Rye smut, E. C. Stakman and M. N. Levine (*Minnesota Sta. Bul. 160* (*1916*), *pp. 3–19, figs. 6*).—A disease of rye variously known as stem smut, stalk smut, and stripe smut, due to the fungus *Urocystis occulta*, is described. The disease is said to cause serious losses in Minnesota, in some localities from 5 to 40 per cent of the plants in the field being infected. The spores are said to live over in the seed or soil, and seed treatment with formaldehyde and planting in clean soil are recommended as control measures. Rotation of crops is advised in order that the fungus may be eliminated from the soil.

The determination of ustilaginous spores in flour, bran, and cereals, G. Bredemann (*Landw. Vers. Stat.*, *87* (*1915*), *No. 4–5, pp. 241–250*).—The author reports further analytical data obtained by the method previously noted (E. S. R., 26, p. 408) and concludes that it yields truer and more reliable, not only relative but positive, results than the procedure described by Gróh (E. S. R., 27, p. 310).

The quantitative determination of smut spores in bran, G. Bredemann (*Arch. Chem. u. Mikros.*, *8* (*1915*), *No. 4, pp. 87–95*).—Tests described are considered to prove the reliability of methods for spore estimation employed by the author (E. S. R., 26, p. 408).

The Texas root rot fungus and its conidial stage, B. M. Duggar (*Ann. Missouri Bot. Gard.*, *3* (*1916*), *No. 1, pp. 11–23, figs. 5*).—Having made a study of the cotton root rot which is common in many portions of Texas, the author describes the causal organism, which, with some modifications of form and habit, attacks also an unknown but probably large number of native plants in that State, under the new combination *Phymatotrichum omnivorum*, retaining the specific name applied thereto by Shear (E. S. R., 19, p. 446).

Spongospora on the roots of the potato and on seven other new hosts, I. E. Melhus and J. Rosenbaum (*Abs. in Phytopathology*, *6* (*1916*), *No. 1, p. 108*).—This fungus, which is commonly considered to infect the tubers, the authors found in greenhouse experiments to involve all the underground parts of the plants. Later, this condition was found to prevail in the field also.

The authors' investigations have shown that Spongospora, in addition to infecting the potato, attacks the tomato and six species of Solanum, *S. commersoni*, *S. ciliatum*, *S. marginatum*, *S. mammosum*, *S. hæmotocladum*, and *S. warscewiezii*.

Meteorology and late blight of potatoes, C. R. Orton (*Abs. in Phytopathology*, *6* (*1916*), *No. 1, p. 107*).—From a study of the meteorological conditions in connection with the late blight of potatoes at the Pennsylvania Experiment Station, the author claims that precipitation alone has little if any bearing on the problem. Atmospheric temperatures alone or when correlated with precipitation do not appear to have much relation to the outbreak of disease. Humidity and soil temperature are believed to bear directly upon the subject.

A Fusarium tuber and stem rot of potato, R. J. Haskell (*Abs. in Phytopathology*, *6* (*1916*), *No. 1, pp. 106, 107*).—The author reports having isolated from the fibrovascular bundles of potato tubers a Fusarium which produces a

very virulent stem and tuber rot. The organism appears to be related to, if not identical with, *F. eumartii*.

Crop yield, tuber color, and leaf roll of potato in relation to soil and fertilizer, J. AHR, C. MAYR, and WÖRLE (*Fühling's Landw. Ztg., 64 (1915), No. 17–18, pp. 425–452, figs. 3*).—Giving details and discussion of several series of experiments dealing mainly with nutritive materials as affecting potato culture, the authors state, in reply to the statements of Schander (E. S. R., 33, p. 433), that apparently without reference to the degree of maturity or the kind of fertilizer, the dark colored tubers of the variety Wohltmann showed in one year under the influence of given soil conditions a lighter color of skin and a corresponding alteration in the growth of the plant, its resistance to disease, and its productivity. Apparently, there is no connection between the appearance of leaf roll and the coloration of the potato, the latter appearing to depend principally upon the physical properties of the soil, which the experiments show to be the preponderating influence in potato production.

Field studies on the Rhizoctonia of the potato, M. T. COOK and H. C. LINT (*Abs. in Phytopathology, 6 (1916), No. 1, p. 106*).—Rhizoctonia diseases of potatoes are said to have been severe in New Jersey in 1915, the attack of the fungus causing poor germination, brown stem, curly leaf, dwarfing, aerial potatoes, and little potatoes, with resultant poor stands, reduced yields, and, in some cases, complete loss of the crop. The results obtained from seed treatment were variable, but corrosive sublimate proved much better than formaldehyde for the prevention of these troubles.

The effect of Bordeaux mixture on the potato plant, B. F. LUTMAN (*Abs. in Phytopathology, 6 (1916), No. 1, p. 108*).—Basing his conclusions on seven years' investigations in this country and one in Germany, the author believes that the beneficial effects of Bordeaux mixture can be ascribed to the prevention of the early appearance of tipburn and of the greater part of flea beetle injury. Of these two effects the former is considered the more important, as tipburn advances much more slowly on sprayed than on unsprayed plants. The cause of this retardation is thought to be some sort of chemical union between the chlorophyll and the copper compounds. Sprayed plants unaffected by tipburn are not found to produce more starch per plant than unsprayed ones.

Biochemical study of root rot in sugar beets, J. BODNÁR (*Ztschr. Pflanzenkrank., 25 (1915), No. 6, pp. 321–325*).—The substance of this report has been noted previously from another source (E. S. R., 34, p. 52).

Fruit tree diseases of southern Ontario, W. A. MCCUBBIN (*Canada Expt. Farms Bul. 24, 2. ser. (1915), pp. 77, figs. 70*).—Popular accounts are given of the diseases of fruit trees known to occur in Ontario. The fungi causing these diseases are described and suggestions given for control measures.

Temperature relations of apple rot fungi, C. BROOKS and J. S. COOLEY (*Abs. in Phytopathology, 6 (1916), No. 1, p. 111*).—According to the authors, apples with natural infections of bitter rot and black rot were stored at various temperatures. The development of bitter rot was slow at 15, rapid at 25, and slow at 30° C. It was completely inhibited at 0, 5, and 10°, but developed rapidly when the apples were removed to a temperature of 25°.

Black rot developed rapidly at 25°, but it had made little progress at 10° at the end of ten days. After two months' storage, there was considerable development even at 0°.

The temperature relations for growth of a number of other fungi occurring on stored apples are also reported upon.

Black root rot of apple, H. R. FULTON and R. O. CROMWELL (*Abs. in Phytopathology, 6 (1916), No. 1, p. 110*).—A form of root rot is briefly described, as it has been observed as serious in a number of places in Pennsylvania and

North Carolina. Pure cultures of the fungus have been made, but the fruiting bodies have not been discovered. The disease is readily produced by introducing the mycelium into bark wounds in the roots, and it is said to develop quite rapidly. The fungus differs in many respects from those ordinarily recognized as root-destroying forms. Its identity has not been determined.

Some effects of the black rot fungus, Sphæropsis malorum, upon the chemical composition of the apple, C. W. Culpepper, A. C. Foster, and J. S. Caldwell (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 1, pp. 17–40*).—A report is given of an investigation, conducted mainly at the Alabama Experiment Station, to determine the changes in the chemical composition of apples attacked by the black rot organism. Comparisons were made of sound, mature Red Astrachan apples with fruit of the same variety in two stages of decay.

A slight loss of water and a considerable reduction in the amount of total solids were found in the completely decayed fruit. There was also a marked reduction, concurrent with the progress of the disease, in the amount of the constituents removed by successive extractions of the pulp with alcohol, ether, and water. A decrease, followed by an increase, was noticed in the absolute, as well as in the relative, amounts of the lipoid constituents extracted by alcohol or ether and precipitated from water emulsion by chloroform.

The nitrogen extracted by alcohol, water, and ether steadily decreased with the progress of the disease, as did also the ammonia. The protein nitrogen increased steadily with the progress of the disease, but there was a small decrease in the total nitrogen due to the complete decomposition of some of the nitrogenous constituents with the escape of ammonia.

Phosphorus in both lipoid and insoluble fractions was materially decreased in the half-decayed fruit. In the completely decayed fruit there was a further reduction in the lipoid phosphorus, an increase in soluble phosphorus, and a very large increase in insoluble or protein phosphorus.

A steady transfer of mineral elements from the insoluble to the soluble fraction was observed. A rapid decrease took place in the content of reducing sugars, disaccharids, and lipoid sugars as the disease proceeded. Of these carbohydrates, the disaccharids were least completely utilized. Starch was not attacked by the fungus, its amount remaining unchanged throughout the progress of the decay. There was a progressive decrease in the acid content of the fruits, and with the advance of the disease a large increase in the alcohol content occurred.

Blister spot of apples, D. H. Rose (*Abs. in Phytopathology, 6 (1916), No. 1, p. 110*).—The author reports upon a disease of apples observed in the summer of 1915, which, it is believed, has not yet been described.

The disease is characterized by the appearance of nearly circular, sometimes irregularly lobed, shallow blisters varying in color from light brown to black and in diameter from 1 to 5 mm. The organism has been isolated, and inoculations made by needle punctures have resulted in typical blister spots in about two weeks on Early Melon, Ishewold, Yellow Newton, and Jonathan.

On the flower wilt and young fruit rot of the apple tree caused by Sclerotinia mali n. sp., Y. Takahashi (*Bot. Mag. [Tokyo], 29 (1915), No. 343, pp. 217–223*).—In this paper the author has described the conidial and ascosporous stages of the fungus causing flower wilt and fruit rot of the apple, the morphological characters of which are said to resemble closely those of *S. kusanoi*, but which gave negative results on inoculation into cherry trees. The fungus is considered a new species and has received the name *S. mali*.

Apple scald, C. Brooks and J. S. Cooley (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 110, 111*).—Experiments are reported upon which are said to indicate

that humidity is more important than carbon dioxid in the amount of scald in apples in storage. The results obtained from the investigations are said to suggest the importance of a relatively low temperature and an open pack for the prevention of scald.

Brown blotch of the pear, G. W. Martin (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 111, 112*).—A brown blotch of the pear which is said to cause a serious disfigurement of the fruit is reported as having been present in the orchards of New Jersey for a number of years. This pear disease seems to have been confused with russeting, which is characteristic of many varieties of pears, and had not been recognized as a pathological condition. It is said to be due to a fungus which is identical with one described under the name *Macrosporium sydowianum* as causing a similar disease in Italy.

It is claimed that the disease may be readily controlled by two late sprayings.

The parasitism of Valsa leucostoma, R. C. Walton and D. C. Babcock (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 112, 113*).—Inoculations with this fungus resulted in 100 per cent infection on the trunks and larger branches of peach trees, cankers being formed in about a month's time. No infections were secured where mycelium was placed over lenticels without wounds. Inoculations of both green and ripe peach fruit gave 94 per cent infection, while plum fruit inoculated gave 97 per cent. Inoculations made in tips of peach branches gave 85 per cent infection, while all checks remained free from disease.

A preliminary report on investigations of leaf spot of cherries and plums in Wisconsin, G. W. Keitt (*Abs. in Phytopathology, 6 (1916), No. 1, p. 112*).—While engaged in a study of diseases of cherry and plum at Sturgeon Bay, Wis., the author found that the most serious leaf injury is due to *Cylindrosporium* spp.

A study was also made of *Coccomyces hiemalis* which causes leaf spot of sour cherry. This disease, it is claimed, was quite satisfactorily controlled on sour cherry trees which received their first application of spray when about three-fourths of the petals had fallen. Field observations indicate that early spring infections could be greatly reduced by plowing under or otherwise disposing of leaves about the bases of trees.

The Surinam witch-broom disease of cacao, J. B. Rorer (*Bul. Dept. Agr. Trinidad and Tobago, 15 (1916), No. 1, p. 5*).—This is a discussion of the article by Stahel already noted (E. S. R., 34, p. 847).

Chestnut tree disease in Ardèche, L. Trabut (*Compt. Rend. Acad. Agr. France, 2 (1916), No. 15, pp. 462, 463*).—Reporting observations made in 1915 on the progress of the chestnut-tree disease in Ardèche, the author recommends the substitution of the cork oak, some varieties of which are resistant to cold, and of *Quercus ballota*, some varieties of which furnish edible acorns.

The influence of the tannin content of the host plant on Endothia parasitica and related species, M. T. Cook and G. W. Wilson (*New Jersey Stas. Bul. 291 (1916), pp. 3–47*).—A report is given of an investigation carried on cooperatively by the Bureau of Plant Industry of this Department and the New Jersey Experiment Station, in which the effect of tannin on the growth of the chestnut blight fungus (*E. parasitica*) and related species was studied. Commercial tannin preparations and some special extracts from chestnut bark were used in the experiments on cultures of *E. parasitica*, *E. radicalis*, and *E. radicalis mississippiensis* from different sources.

The results obtained with commercial tannin were not always comparable among themselves nor with those obtained when the specially prepared extracts were used. In almost every instance, without regard to the form of

tannin, a content of 0.8 per cent or more caused a retardation of germination, frequently followed by an abnormal stimulation of the growth of aerial mycelium. The species of Endothia and to some extent the strains of the same species showed considerable variations in their response to tannin. In the course of the investigations it was found that tannin was utilized by *E. parasitica*, the fungus being able to remove as much as 2 per cent from the substratum. The specially prepared extracts of pure tannin were either stimulating or only slightly toxic when combined with coloring matter or other substances associated with tannins.

The chestnut blight and the white pine blight rust, A. B. Brooks (*W. Va. Dept. Agr. Bul. 12* (*1915*), *pp. 21, figs. 9*).—This bulletin gives a general account of the chestnut disease due to *Endothia parasitica* and a very brief discussion of the blister rust of 5-leaved pines, the causal fungus of which has for its alternate host currant or gooseberry.

Eelworm parasites of plants, P. Frandsen (*Mo. Bul. Com. Hort. Cal.*, *5* (*1916*), *No. 2, pp. 60–63, fig. 1*).—This is an address made before the State Fruit Growers' Convention, Palo Alto, Cal., 1915, giving the collected information and results of recent experience regarding nematodes. Particular reference is made to *Heterodera radicicola*, which is increasing in importance in the Western States, about 500 species of plants, including the majority of truck garden crops, alfalfa, clovers, some grains, a number of fruit trees, and many weeds, now being known to be susceptible to this parasite.

The young nematodes, as a rule, enter through the tip of the rootlet, but they also pass into the young potato tubers through the lenticels, several entering frequently at the same point. They are distributed by such means as seed potatoes and transplanted seedlings, irrigation being one of the most important agencies. Soil thoroughly dried on tools or carried before the wind apparently does not convey infection. Eggs and larvæ are apparently completely destroyed in the stomach of animals fed upon infected plants. They resist freezing temperatures for a limited time only, the long, cold winters of the Northern States keeping them down in these localities. Character and consistency of soil are thought to play a part also in frost resistance. At least three months' time will be required to eradicate eelworms by flooding with water, but drying for a few minutes will kill eggs or larvæ, either on glass slides or on roots and tubers. There is also very little resistance to heat. In 23 hours, infested potatoes were free from live parasites, yet unimpaired as to germinability. It is thought probable that seed potatoes are safe after 24 hours' exposure to a temperature of 40° C. (104° F.). One per cent copper sulphate, acting for two days on the nematodes, had no effect. Formalin is also ineffective.

Remedies suggested include the use of uninfested soil and seed, summer fallowing of infested ground, deep plowing with consequent exposure of the soil to the sun's rays in hot, dry weather, and a system of rotation employing nonsusceptible crops, a number of which are mentioned. A marked infection is said to have been obtained in an experiment with corn and oats, which have been previously considered as immune.

Injuries to plants kept in rooms, P. Sorauer (*Ztschr. Pflanzenkrank.*, *25* (*1915*), *No. 6, pp. 325–335*).—Observations on several house plants as detailed are considered to show that though injury from burning gas is theoretically possible, this cause is practically inoperative and is easily avoided entirely by ventilation. The injury which may be observed in case of several plants is probably due to the elevation of temperature and the drying of the atmosphere by the means employed to warm the air of the room.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Zoological record, D. SHARP (*Zool. Rec., 51 (1914), pp. VI+[913]*).—This continuation of the catalogue previously noted (E. S. R., 33, p. 450) records the literature of 1914 and includes entries for earlier years that were received too late for inclusion in the previous volume.

Game laws for 1916.—A summary of the provisions relating to seasons, export, sale, limits, and licenses, T. S. PALMER, W. F. BANCROFT, and F. L. EARNSHAW (*U. S. Dept. Agr., Farmers' Bul. 774 (1916), pp. 64, figs. 4*).—This bulletin containing the seventeenth annual summary of the game laws of the United States and Canada has been prepared on the same general plan as those issued each year since 1902 (E. S. R., 34, p. 157). It includes the proclamation of the President and the amended regulations for the protection of migratory birds, approved August 21, 1916, and the treaty with Great Britain for the protection of migratory birds in the United States and Canada, ratified August 29, 1916.

Second annual report of bird counts in the United States, with discussion of results, W. W. COOKE (*U. S. Dept. Agr. Bul. 396 (1916), pp. 20, fig. 1*).—A second count of the birds of the United States, here reported, is said to corroborate the general results obtained by the preliminary work of 1914, previously noted (E. S. R., 32, p. 648).

The counts made in the Northeastern States during 1915 confirm those of the previous year and are said to indicate with reasonable assurance that one pair per acre is the average bird population in that part of the northeastern United States actually devoted to agriculture.

"An average of the returns of counts shows that, on farms where counts were made in that part of the Plains region east of the one-hundredth meridian and in the whole of the Southern States, for the part of the farm surrounding the farm home there is almost exactly the same density of bird population—for the former 125 and for the latter 131 pairs of nesting birds to each 100 acres—but the counts so far received do not furnish a sufficient basis for estimating the birds on the remainder of the farm. The data received tend to indicate that the western part of the Plains, the Rocky Mountain region, and the Pacific slope contain a smaller number of birds per acre than the Eastern States, but as yet no numerical statement may be attempted. . . .

"A bird population of 70 pairs of native birds of 31 species on 8 acres, at Olney, Ill.; 135 pairs of 24 species on 5 acres, at Wild Acres, Md.; 193 pairs of 62 species on 44 acres, at Indianapolis, Ind.; and 189 pairs of 40 species on 23 acres, at Chevy Chase, Md., a half acre of which showed 20 pairs of 14 different species; all indicate how largely birds will respond to food, shelter, and protection."

A field ornithology of the birds of eastern North America, C. J. MAYNARD (*West Newton, Mass.: Author, 1916. pp. 550, pl. 1, figs. 424*).—A popular handbook for field use.

Common birds of southeastern United States in relation to agriculture, F. E. L. BEAL, W. L. MCATEE, and E. R. KALMBACH (*U. S. Dept. Agr., Farmers' Bul. 755 (1916), pp. 39, figs. 20*).—This deals with the food habits and economic importance of 23 species of birds that commonly occur in the southeastern United States.

How to attract birds in northwestern United States, W. L. MCATEE (*U. S. Dept. Agr., Farmers' Bul. 760 (1916), pp. 11, figs. 11*).—This is the second of a series of publications (E. S. R., 32, p. 347) in which the means of attracting and providing food supplies for wild birds about homesteads in the Northwestern States are especially described.

Birds in their relations to man, C. M. Weed and N. Dearborn (*Philadelphia and London: J. B. Lippincott Co., 1916, 2. ed., rev., pp. VIII+390, pls. 18, figs. 103*).—A revised edition of the work previously noted (E. S. R., 15, p. 228).

A new air-conditioning apparatus, G. A. Dean and R. K. Nabours (*Kansas Sta. Rpt. 1915, pp. 46–54, figs. 4*).—Previously noted in part from another source (E. S. R., 33, p. 855).

Effects of nicotin as an insecticide, N. E. McIndoo (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 3, pp. 89–121, pls. 3*).—The studies here reported in detail have been summarized by the author as follows:

"Nicotin spray solutions do not pass into the tracheæ, nor do they penetrate the integuments of insects. The fumes from nicotin used as a fumigant, the vapors from nicotin spray solutions, and the odoriferous particles from evaporated nicotin spray solutions or from powdered tobacco pass into the tracheæ and are widely distributed to all the tissues.

"Regardless of how it is applied, whenever nicotin kills insects, as well as all other animals, it kills by paralysis, which in insects travels along the ventral nerve cord from the abdomen to the brain. The writer does not know just how nicotin paralyzes the nervous system, but he does know that it prevents the nerve cells from functioning, and that in regard to the simplest animals its presence around the cells causes the same structural changes resulting in death as observed when other animals of the same kind are deprived of oxygen. In such cases it seems to kill physically rather than chemically, but the evidence presented does not conclusively prove this view. In the higher animals it may kill by interfering with oxidation in the cells; whether this is accomplished physically or chemically the writer does not know, but concluding from the properties of nicotin he is inclined to attribute more to its physical effects than to its chemical effects."

A bibliography of 25 titles is included.

Insects injurious to alfalfa, G. A. Dean (*Kans. Agr. Col. Ext. Bul. 5 (1916), pp. 36, figs. 40*).—Summarized accounts are given of the more important insect enemies of alfalfa, including methods of control.

Insects attacking onions, H. A. Ballou (*Agr. News [Barbados], 15 (1916), Nos. 366, p. 154, fig. 1; 367, pp. 170, 171*).—A brief account of the insect enemies of onions in the West Indies, of which the onion thrips ranks first in importance.

The more important greenhouse insects, H. B. Weiss (*New Jersey Stas. Bul. 296 (1916), pp. 3–42, figs. 33*).—This bulletin gives summarized accounts of the more important insect pests occurring in greenhouses, including control measures.

The animal parasites of man, H. B. Fantham, J. W. W. Stephens, and F. V. Theobald (*New York: William Wood & Co., 1916, pp. XXXII+900, figs. 423*).—This work is partly adapted from the fourth edition of Braun's Die Tierischen Parasiten des Menschen, the English or third edition of which has been noted (E. S. R., 17, p. 1011).

Following an account of parasites in general the protozoa are taken up in the first section (pp. 25–210) and in an appendix (pp. 733–752) by H. B. Fantham; the worms in the second section (pp. 211–482) and in an appendix (pp. 753–755) by J. W. W. Stephens; and the arthropods in the third section (pp. 483–616) by F. V. Theobald. A supplement containing clinical and therapeutical notes on the protozoa, worms, and arthropods (pp. 617–732); a bibliography (pp. 756–835); and an index (pp. 836–900) are also included.

New Jersey's insects, H. B. Weiss (*Sci. Mo., 3 (1916), No. 4, pp. 385–388*).—It is stated that of the insects listed from New Jersey, namely, 10,530, only 1.76 per cent are really destructive.

Reports of the government entomologist, 1915 and 1916, C. MASON (*Nyasaland Dept. Agr. Ann. Rpts. 1915, pp. 36–49; 1916, pp. 19–22*).—These reports record the occurrence of the more important insect pests of the years and the control measures applicable.

Some new entomogenous fungi in St. Vincent, W. NOWELL (*Agr. News* [*Barbados*], *15* (*1916*), *No. 363, p. 110*).—Reference is made to a new species of Cordyceps that attacks the larvæ of *Cryptorhynchus corticalis*, a species of Isaria on the larva of a root weevil, an undetermined fungus on the larvæ and adults of the cacao thrips (*Heliothrips rubrocincta*), and undetermined forms on the West Indian peach and purple scales.

The lesser migratory locust (Melanoplus atlanis), G. W. HERRICK and C. H. HADLEY, JR. (*New York Cornell Sta. Bul. 378* (*1916*), *pp. 5–45, pls. 6, figs. 17*).—The lesser migratory locust, a native species widely distributed in the United States and Canada, has at times been a most destructive pest. In 1893 and 1894 it caused considerable injury to crops in the western counties of New York State, and during the past three years certain sandy sections of Clinton, Warren, Saratoga, Fulton, and to a less extent other counties, were subjected to an exceedingly severe outbreak. Rye, oats, and corn are said to have suffered the most, probably because they are the chief crops in the infested localities.

Oviposition commences about the middle of July and continues until cool weather sets in. The young nymphs, which hatch out in the spring, undergo five molts before reaching maturity in June, there normally being but one generation a year in New York State.

Control measures consist of fall and spring plowing of the breeding places to a depth of 6 or more inches, the use of the so-called Kansas poison bait, the hopperdozer, and spraying with arsenicals.

Brief notes are presented on related forms in New York, including the red-legged grasshopper (*M. femur-rubrum*), the two-stripped grasshopper (*M. bivittatus*), the clear-winged locust (*Camnula pellucida*) the Carolina locust (*Dissosteira carolina*), and the green-striped grasshopper (*Chortophaga viridifasciata*).

A bibliographical list of 34 titles is included.

The sugar-beet thrips, W. H. WHITE (*U. S. Dept. Agr. Bul. 421* (*1916*), *pp. 12, pls. 2, figs. 8*).—A report of studies at Washington, D. C., of the sugar-beet thrips (*Heliothrips femoralis*), which is widely distributed in Europe and the United States, occurring principally in greenhouses. It has been taken outofdoors on sugar beets and sugar cane and has a large number of food plants. At an average mean temperature of 73° F. the eggs required from 12 to 14 days for development and the four nymphal stages required 4, 8, 1, and 5 days, respectively. It was found that a spray, consisting of nicotin sulphate 6 oz., fish-oil soap 4 lbs., and water 50 gal., destroyed all the adults and 95 per cent of the nymphs.

Technical descriptions are given of its several stages and a bibliography of 18 titles is included.

The bedbug, C. L. MARLATT (*U. S. Dept. Agr., Farmers' Bul. 754* (*1916*), *pp. 12, figs. 4*).—This replaces the publication previously noted (E. S. R., 14, p. 374).

The chinch bug outbreak of 1910 to 1915, S. A. FORBES (*Illinois Sta. Circ. 189* (*1916*), *pp. 3–59, figs. 13*).—This is a report of studies made during an outbreak of the chinch bug, the first beginnings of which were seen in Illinois in the fall of 1909 and continued with growing intensity and gradually widening area until the spring of 1915, when it collapsed.

"A careful computation of losses resulting, based upon a comparison of crop yields and crop conditions in 17 infested and 17 uninfested counties, shows

that the yield of corn, wheat, and oats in these infested counties was diminished by chinch bug infestation in the year 1914 as follows: Corn, $5,015,874; wheat, $1,356,039; oats, $41,071—a total of $6,442,984. . . .

"An analysis of the weather and other conditions for several years in the region where the chinch bug outbreak began, points to a conclusion that the immediate cause of its beginning was unusually hot midsummer weather, with no excessive rainfall, occurring in a region in which the food plants occupied a relatively large area, with winter wheat in especially large ratio. . . . The outbreak was brought to a conclusion in the spring and early summer of 1915 by heavy beating and flooding rains coming at times when the young bugs were hatching rapidly from the egg.

"The principal measures for the control of a chinch bug outbreak are the burning out of the insects in their winter quarters and their destruction at harvest time by means of impassable barriers and lines of post-hole traps placed beside infested fields of wheat. Although winter burning on a large scale proved impracticable in Illinois owing to wet and snowy winters, small scale field experiments with this operation, under conditions locally and temporarily favorable, destroyed from 50 to 75 per cent of the chinch bugs under the harborage burned over."

Experiments made with a view to finding a better material than coal tar for making barriers against the escape of chinch bugs at wheat harvest resulted in the selection of a petroleum product, a residue of distillation, containing 70 per cent of asphaltic materials and known as road oil No. 7. While a perfect substance for the purpose this material, however, has the disadvantage that it is not on the market and must be made solely for this special use. A farmer's chance experiment made in 1912 showed that crude creosote was almost as effective as coal tar or road oils, and it had the advantage that it could always be obtained without delay in any desired quantity from near-by sources of supply, and so was the substance principally used during the last year or two of the outbreak. Experiments showed that creosote differed from coal tar and the road oils in the cause of its effectiveness, the latter being impassable because they were thick and sticky, while the creosote repelled the insects by odorous vapors given off.

"Field experiments with practical operations, especially in 1910, 1911, and 1912, showed that an effective barrier could be made and maintained at an expense for labor and materials varying from $1.50 to $2 per day per mile, the difference depending mainly upon the character of the season."

The false chinch bug and measures for controlling it, F. B. Milliken (*U. S. Dept. Agr., Farmers' Bul. 762* (*1916*), *pp. 4, figs. 2*).—A severe outbreak of the false chinch bug (*Nysius ericæ* [*angustatus*]) during May and June, 1916, especially in Kansas and Colorado, led to the preparation of this information regarding control measures.

Are scales becoming resistant to fumigation? H. J. Quayle (*Univ. Cal. Jour. Agr., 3* (*1916*), *No. 8, pp. 333, 334, 358*).—The author discusses fumigation experiments with fruit from different sections showing apparently that the red scale in the Corona district is more resistant than in Orange County.

Root louse control, D. Hansen (*U. S. Dept. Agr., Bur. Plant Indus., Work Huntley Expt. Farm, 1915, pp. 16–18*).—Experimental control work with the sugar beet root louse (*Pemphigus betæ*), accounts of which by Parker have been previously noted (E. S. R., 33, p. 357), was carried on in cooperation with the Montana Experiment Station.

Due to an unusually heavy rainfall in June and July the soil on all the plats was thoroughly moist most of the time during the migration period and

the amount of injurious infestation on all the plats was comparatively small. As a result tests made of several methods of irrigation failed to give conclusive results. It is believed, however, that the results obtained in 1914 and 1915 indicate that control by irrigation will be effective only in years when the precipitation is not above normal.

In tests of plats of land, three of which had been in oats the previous year and six in beets, the infestation of the beets which followed the oats was 70.3 per cent and the percentage injuriously infested 4.7, while of those which followed beets only 28.9 per cent were infested in any degree and only 0.73 per cent injuriously infested. These observations support the theory that the root louse usually does not hibernate in old beet fields.

The grape leaf-folder, J. F. Strauss (*U. S. Dept. Agr. Bul. 419* (*1916*), *pp. 16, pls. 4, figs. 6*).—The author reports studies of the life history and habits of *Desmia funeralis* made in the vicinity of Washington, D. C., during the course of two years.

The injury which it causes, principally to the foliage of the grape, has frequently been described since 1885. The larvæ of the first brood have also been observed to eat the blossoms and young fruit. As soon as it is large enough the larva folds the leaf, exposing the undersurface, and within the protection of this fold skeletonizes the upper surface. Later in the season the skeletonized leaf dries up and exposes the fruit to the rays of the sun, which in case of a severe attack renders the fruit unmerchantable.

The pest occurs in all regions of the United States where wild or cultivated grapes grow, and extends into a considerable portion of Canada, but it has not as yet, with occasional exceptions, assumed the proportions of a pest of much economic importance outside of the Central States between the latitudes of 35 and 40°. It has been collected on the fox grape (*Vitis labrusca*), southern fox grape (*V. rotundifolia*), *V. cordifolia*, the Virginia creeper (*Parthenocissus quinquefolia*), and two varieties of redbud (*Cercis canadensis* and *C. chinensis*).

At Washington, D. C., the greatest number of moths issued during the early part of May, but adults have been obtained the latter part of April, through May, and most of June. The eggs are usually deposited singly on the underside of the leaf, along the midrib or other veins, or in the angles formed by the branching of the veins, and have also been found scattered over the grape canes. The eggs hatch in from 8 to 10 days. The larva, which molts six times, feeds almost continuously during the first three or four days between molts, being especially active at night. In the latitude of Washington, there are two generations each year. The majority of the first brood larvæ pupate during July, the average length of time passed in the larval stage being about 4 weeks. The larvæ of the second brood begin to pupate in September and by the middle of October few, if any, are to be found in the leaves in the latitude of Washington. The full-grown larvæ leave their shelters and drop to the ground, where they transform among fallen leaves, trash, etc., and in the case of the second brood, pass the winter as pupæ.

Seven hymenopterous and 3 dipterous parasites are recorded as having been reared by the author from the grape leaf-folder, of which notes are given on *Apanteles canarsiæ*, *Meteorus dimidiatus*, *Pardianlomella ibseni*, *Habrobracon johannseni*, and *Exorista pyste*.

As regards control measures it is stated that vineyards regularly sprayed with arsenicals for the control of the grape rootworm, grape-berry moth, etc., will be practically free from injury by the grape leaf-folder. Where it has been troublesome in previous years, it is recommended that the vines be

sprayed with arsenate of lead at the rate of 2 lbs. of the paste or 1 lb. of the powdered article to 50 gal. of water, shortly after the blossoms have fallen.

A bibliography of 26 titles is included.

Tinea cloacella as a mushroom pest, A. Krausse (*Ztschr. Forst u. Jagdw., 48 (1916), No. 2, pp. 73–78, figs. 12*).—This reports morphological and biological studies of *T. cloacella*, which was found to develop in an edible mushroom, *Boletus edulis.*

Experiments during 1915 in the destruction of fly larvæ in horse manure, F. C. Cook and R. H. Hutchison (*U. S. Dept. Agr. Bul. 408 (1916), pp. 20*).—This bulletin reports the results of investigations carried on during 1915 in continuation of those of 1913 and 1914, previously noted (E. S. R., 33, p. 455). During the fly season the larvicidal action of infusions of 18 plant materials was tested, none of which, with the exception of hellebore, was sufficiently economical and effective to be classed as a practical larvicide.

Summarizing the results of the three seasons' work, it is stated that borax, used at the rate of ⅝ lb. to 10 gal. of water and sprinkled over 8 bu. of manure, is the least expensive and the most effective larvicide. It is pointed out that caution should be used, however, in treating manure to be used for agricultural purposes because of the injurious action on plant growth of excessive applications of borax. Powdered hellebore, used at the rate of 0.5 lb. to 10 gal. of water on 8 bu. of manure, is an effective larvicide and without action on plant growth. The indications are that calcium cyanamid, acid phosphate, and kainit mixtures can be used as effective larvicides if 0.5 lb. of calcium cyanamid is present in the mixture per bushel of manure treated.

The response of the house fly (Musca domestica) to ammonia and other substances, C. H. Richardson (*New Jersey Stas. Bul. 292 (1916), pp. 3–19*).—The studies here reported, preliminary accounts of which have been previously noted (E. S. R., 34, p. 160; 35, p. 466), have led to the following conclusions:

House flies are attracted to fermenting organic substances largely by the odor of ammonia, a product of this fermentation. Ammonia attracts a preponderance of females. Flies can be induced to oviposit upon certain substances near which ammonia is volatilized. Flies lay their eggs by preference in organic substances which are capable of furnishing food for their larvæ and they have some power which enables them to detect such substances. Butyric and valerianic acids augment the oviposition response of the house fly to ammoniated cotton.

Flies and their relation to epidemic diarrhea and dysentery in Poona, J. Morison and W. D. Keyworth (*Indian Jour. Med. Research, 3 (1916), No. 4, pp. 619–627, figs. 3*).—"The evidence indicates that flies, in spite of their number, do not contribute appreciably, if at all, to the mortality in the native city of Poona, or to the annual epidemic of gastro-intestinal disease in Poona cantonment."

[Report of the] department of entomology, H. T. Fernald (*Massachusetts Sta. Rpt. 1915, pt. 1, pp. 65a–68a*).—This brief report of the work of the year deals particularly with the strawberry crown girdler (*Otiorrhynchus ovatus*), which in the spring of 1915 appeared in enormous numbers in a forest nursery and caused an estimated loss of over $15,000. Examinations made of beds of 2-year-old white pines, the tops of which were turning brown, showed that the larvæ had girdled the stems and roots at from 1 to 3 in. below the surface of the ground. In addition to white pine, the red pine, Scotch pine, *Juniperus virginiana*, blue, Douglas, and Norway spruce, and even sugar maple seedlings of the 2-leaf age were attacked, and in many cases severely injured. When first examined, on May 15, the larvæ were nearly mature and most of them pupated within two weeks thereafter. The beetles were appearing by the mid-

dle of June and were at their maximum abundance about July 7. The evidence would indicate that in this infestation at least some portion of the larval feeding took place in the fall and was resumed in the spring, and that the adult period of life extended over several months.

Examinations of beds that had been stripped of plants and cultivated every two or three days as recommended showed numerous dead pupæ, but indicated that some larvæ at least pupated lower than a harrow would reach. This led to the recommendation that plowing be done once or twice in order to reach the more deeply-placed pupæ. Later when the beetles emerged trapping methods were resorted to with considerable success, weed piles placed between the beds having proved more effective than the use of boards or burlap. The use of repellants was recommended and it is advised that beds cleared of plants be not reset until the adult beetles disappear.

The soy bean stem borer, H. L. DUTT (*Agr. Jour. Bihar and Orissa [India], 3 (1915), No. 1, pp. 52–56, figs. 3*).—With the introduction of the soy bean on an experimental scale at Sabour a cerambycid beetle of the genus Nupserha has appeared and become a source of serious damage. An account is given of its life history and habits, together with recommendations as to the prevention of injury, and remedial measures.

Rhynchophora or weevils of northeastern America, W. S. BLATCHLEY and C. W. LENG (*Indianapolis: The Nature Publishing Co., 1916, pp. 682, figs. 155*).—This volume, following the plan adopted in the senior author's Coleoptera or Beetles of Indiana (E. S. R., 24, p. 259), furnishes keys to the families, subfamilies, tribes, genera, and species of Rhynchophora. A total of 1,084 species are described as occurring in the United States and Canada, east of the Mississippi River. The description of each species is followed by notes on its distribution, food, habits, etc., so far as known. The classification used is mainly that of LeConte and Horn, modified where necessary by recent studies.

A bibliography of the principal works to which reference has been made in the text, and an index to the plants mentioned, to the families, subfamilies, tribes, and genera, and to the new genera, species, and varieties, are included.

The cottonwood borer, F. B. MILLIKEN (*U. S. Dept. Agr. Bul. 424 (1916), pp. 7, pl. 1, figs. 3*).—This is a report of studies of *Plectrodera scalator* in cottonwood (*Populus deltoides*) and willow (*Salix alba*) made at Garden City, Kans., in 1913.

The eggs are deposited in the trunks of cottonwoods at or a little below the surface of the ground, principally during July and August. The young larvæ cut the bark and prevent the sap flow and the large larvæ tunnel the wood, thus weakening the resistance of the trees to the wind. The adults emerge from about the middle of June to the first of August of the second summer following emergence from the eggs.

It is pointed out that oviposition in shade trees may be prevented by screening the bases and directions are given for the preparation of such screens. "The young larvæ can be removed before they injure the trees severely if the remedial work is done during the first two weeks of September, but removal of the large larvæ from deep tunnels often injures the trees more than would the larvæ if allowed to remain and complete their development."

The southern corn billbug, Z. P. METCALF (*N. C. Agr. Ext. Serv. Circ. 19 (1916), pp. 21, figs. 13*).—This is a summarized account of a pest that is a very destructive enemy of corn in the eastern part of North Carolina. Reports of studies made of this insect by Smith in North Carolina (E. S. R., 29, p. 56), Kelly in southern Kansas and northern Oklahoma (E. S. R., 25, p. 159), and Hayes in southern Kansas (E. S. R., 35, p. 760) have been previously noted.

The banana weevil, H. A. Ballou (*Agr. News [Barbados], 15 (1916), No. 364, p. 123*).—It is reported that the banana weevil (*Sphenophorus [Cosmopolites] sordidus*) has appeared in some numbers in certain districts of Jamaica.

Productive beekeeping, F. C. Pellett (*Philadelphia and London: J. B. Lippincott Co., 1916, pp. XIV+302, pl. 1, figs. 134*).—In this volume the state apiarist of Iowa considers modern methods of production and marketing of honey.

Bees and how to keep them, F. W. L. Sladen (*Canada Expt. Farms Bul. 26, 2. ser. (1916), pp. 56, pls. 4, figs. 34*).—This replaces the bulletin previously noted (E. S. R., 27, p. 662).

Fifteenth annual report of the Illinois State Beekeepers' Association, compiled by J. A. Stone (*Ann. Rpt. Ill. Beekeepers' Assoc., 15 (1915), pp. 177, pl. 1, figs. 9*).—This report (E. S. R., 35, p. 467) includes a paper on Outdoor Wintering (pp. 51–58), by E. F. Phillips.

Rocky Mountain spotted fever.—A report of laboratory investigations of the virus, L. D. Fricks (*Pub. Health Rpts. [U. S.], 31 (1916), No. 9, pp. 516–521, fig. 1*).—A report of studies of the causative organism of the disease, which is transmitted by *Dermacentor venustus.*

FOODS—HUMAN NUTRITION.

The nutritive properties of corn, A. G. Hogan (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 193–208*).—Feeding experiments with laboratory animals (rats) are reported in an attempt to determine the nature of the deficiency of an exclusive diet of maize. The problems studied include the adequacy of the inorganic constituents, the adequacy of maize proteins, and the presence of growth accessories. The results of the work are summarized by the author as follows:

"The evidence indicates that when corn is fed to rats as the sole dietary the mineral constituents are the first limiting factor, and then the protein. In the case of swine these findings are apparently reversed. Protein is here the first limiting factor, and then the mineral element. The data also indicate that the corn proteins are less efficient for growth than casein. The addition of lysin and tryptophane to maize did not increase its efficiency for growth. The addition of some of the adequate proteins (egg white) seemed of only slight benefit. In view of these facts it seems possible that one of the limiting factors in corn as a food for growing rats is one or more of the growth accessories.

"Young rats on a corn diet grow more rapidly when the grain is supplemented with casein than when supplemented with egg white. This observation assumes added significance since food mixtures containing protein-free milk, butter, and egg white are more efficient for growth than mixtures of corn and egg white, even though the protein of the corn mixture furnishes a relatively higher percentage of calories than does the protein of the more efficient diet.

"Autoclaved corn mixtures failed to maintain body weight, and ultimate failure resulted.

"Since swine grow rapidly on a mixture of corn and egg white, it is believed that corn contains sufficient of the growth accessories for normal growth in swine."

The nutritive value of yeast, polished rice, and white bread, as determined by experiments on man, C. Funk, W. G. Lyle, D. McCaskey et al. (*Jour. Biol. Chem., 27 (1916), No 1, pp. 173–191*).—In the investigation here reported four normal men were given a diet of yeast, white rice, and bread.

It was found in the experiments where yeast was taken for nearly two weeks that it was insufficiently utilized, the nitrogen content of the feces being high, and in some instances undigested yeast was detected in the feces. The authors state that yeast, on account of its high purin content, "causes a distinct rise of uric acid in the blood, and for this reason can not be used to the exclusion of all other food."

The experiments with vitamin-free food, in the form of white rice and white bread, confirmed the results of other investigators who found that to obtain the positive nitrogen balance more white bread is required than whole wheat bread or potatoes. This positive balance occurred in spite of the low nitrogen content of the feces and indicated good resorption. The experiments were not of sufficient duration to determine whether the low value of the vitamin-free food was due solely to the absence of vitamins.

As a result of the investigations the authors conclude as follows:

"Yeast can not very well be recommended as a sole protein source, as a large part of the yeast nitrogen apparently has no food value. It is badly assimilated and occasions a rise of uric acid figures in the blood. The amount of nitrogen which would be fully adequate in the form of potatoes was proved to be insufficient with yeast. This also applies to . . . [the] experiment with white bread and white rice. . . . [The authors] were unable in . . . [their] experiment to get a positive nitrogen balance by the addition of vitamin."

In the authors' opinion the investigation does not warrant the verdict that yeast possesses no value in dietetics. There are a number of complex factors which must be taken into consideration, such as problems of personal idiosyncrasy as to the taste and methods of administration of the yeast and questions of amino acid synthesis after the yeast protein and purin bases have entered the organism. There is need of further research to determine how far anaerobic yeast can be made of any supplementary metabolism value when consumed in conjunction with other foods to remedy dietetic deficiencies.

Rye flour and rye bread, E. BRAUN (*Northwest. Miller, 108 (1916), No. 8, pp. 513, 514, figs. 7*).—The author discusses the difference in treatments necessary for rye and wheat flour sponge, and describes methods for making Russian black bread, German black bread, Pomeranian barley bread ("gerstel brot"), and pumpernickel.

Some tests of flour made from Egyptian wheats, F. HUGHES (*Min. Agr. Egypt, Tech. and Sci. Serv. Bul. 10 (1916), pp. 1–9, figs. 5*).—The "strength" of various Egyptian wheats was estimated by noting the size of the loaf as determined by the measurement of the gas evolved on fermenting flours with yeast.

The strength and nitrogen content of Indian wheat was found practically the same whether grown in India or Egypt. Red grains seemed to have a greater strength and greater nitrogen content than white grains, perhaps due to the time of harvesting. The addition of mineral manures to the soil increased the amount of fermentable material by nearly 30 per cent, although the nitrogen content remained practically unchanged. No actual baking experiments were made.

[Inspection of shellfish] (*Maine Sta. Off. Insp., 78 (1916), pp. 41–52*).—Data are given regarding the examination of samples of clams, scallops, and oysters, purchased in the fall and winter of 1915 and 1916. The effect upon the nutritive value of soaking or floating shellfish in fresh water is discussed, standards are given regarding the sale of shellfish, and a statement as to administration made by A. M. G. Soule.

Studies on growth.—III, The comparative value of lard and butter fat in growth, C. Funk and A. B. Macallum (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 51–62, figs. 2*).—The experiments reported in this paper were carried out to determine the relative value of lard and butter fat as the fat fraction of the artificial diets studied in previous work in this series (E. S. R., 34, p. 561).

If laboratory animals (rats) were maintained on a diet containing dried, powdered yeast and lard as the fat component, they grew normally for from 60 to 90 days but eventually displayed scorbutic symptoms. This condition terminated fatally if the diet was not changed. By substituting moist yeast or autolyzed yeast for the dried preparation the rats could be maintained upon the diet for a longer period. Similar results were obtained by adding to the drinking water orange juice (which has neither growth-promoting nor maintaining properties unless supplemented by yeast).

The diets in which butter partially or wholly replaced lard had a slight superiority over those containing lard alone. This superiority was more than could be explained by the antiscorbutic properties of the butter. Even in this case the existing deficiencies were not entirely corrected, since many rats declined on the diet. Rats which failed on lard did not always recover on a diet containing butter.

It appeared possible also that yeast, on account of its high content in purins, and perhaps other constituents, was not an ideal addition to the diet in experiments of long duration, even in spite of its marked growth-promoting power. "The impaired nutritive value of heated casein does not seem to be due to destruction of amino acids but to destruction of vitamins."

Studies on growth.—IV, The action of yeast fractions on the growth of rats, C. Funk and A. B. Macallum (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 63–70, figs. 2*).—Attempts were made to separate out a physiologically active fraction from yeast, which would stimulate the growth of young laboratory animals (rats). This was suggested by the close relationship existing between the beri-beri and growth problems. The authors state that the same experimental difficulties encountered in the investigation of the beri-beri vitamin were encountered in this study, and that the problems of neither beri-beri nor growth will be solved until more adequate methods for the isolation of the vitamin are available.

"The fractionation of yeast with phosphotungstic acid shows that the growth-promoting substance is carried down with the precipitate, and a large part of its activity is lost during the fractionation."

The isolation of a growth-producing substance from sheep pancreas, W. H. Eddy (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 113–126, figs. 9*).—In attempting to establish the presence of a vitamin in the water-soluble portion of the alcoholic extract of sheep pancreas, feeding experiments were made with laboratory animals (rats). The following solutions were used: A filtered water-soluble portion of the alcoholic extract of pancreas; Lloyd's reagent after shaking with the water-soluble portion of the alcoholic extract; the filtrate from the water-soluble portion after treatment with Lloyd's reagent; and the phosphotungstic precipitate of the water-soluble portion after the removal of phosphotungstic acid with amyl alcohol.

The results of these experiments seemed to prove that the water-soluble portion of the alcoholic extract of pancreas contains a substance capable of inducing marked increase in growth. This substance, which is neither a protein nor a fatty substance, is removed from the extract without loss of power by treatment with Lloyd's reagent, and is also precipitated by phosphotungstic acid. Amino nitrogen determinations made on the different solutions used

indicated that the growth stimulation is something other than amino-acid stimulus.

The study of certain dietary conditions bearing on the problem of growth in rats, C. FUNK and J. POKLOP (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 1–14, figs. 4*).—This paper presents data obtained in observation of several hundred laboratory animals (rats), regarding the influence exerted by various substances, which bring about a better condition of the laboratory animals not only from the standpoint of nutrition but from the standpoint of correcting deficiencies in diet. The results obtained are summarized as follows:

"By an addition of milk or yeast to the normal diet, the growth of rats can be accelerated. Oats in dry state or subjected to germination proved to be an inadequate diet for young rats. Yeast can not substitute the casein in the diet and this very likely because of its toxic properties. Young rats grow less when milk instead of yeast is used in the diet, and they do not grow at all on orange juice as addition. Using Lloyd's reagent for precipitation of the growth-promoting substance from autolyzed yeast, it was found that by this process the separation seems to be not complete; furthermore, the yeast loses some of its original value as a stimulant to growth."

Dietetic deficiency, H. H. GREEN (*So. African Jour. Sci., 12 (1916), No. 8, pp. 289–308*).—A summary and digest of data regarding the relation of so-called vitamins to the following deficiency diseases: Beri-beri, scurvy, pellagra, rickets, and osteomalacia, and lamziekte and other deficiency diseases of cattle.

Studies in creatin metabolism.—I–IV, F. P. UNDERHILL and E. J. BAUMANN (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 127–139, 141–146, 147–150, 151–160*).—Four papers are presented.

I. *Possible interrelations between acidosis and creatin elimination.*—In the experiments here reported laboratory animals (rabbits) were fed upon diets containing an adequate carbohydrate supply, but of such a nature that one diet would yield ash of pronounced acidity, another a distinctly basic ash, and a third type of diet consisting of a mixture of the two. The acid-producing foods were whole oats and cracked corn, and the base-producing food was fresh carrots.

It was found that upon a diet of oats and corn furnishing an adequate supply of carbohydrate creatin appeared promptly in the urine of the animal. This phenomenon was associated with marked acidosis as measured by the hydrogen ion concentration of the urine. Oats and corn were found to be pronounced acid-producing foods, but if a base-producing food, such as carrots, was fed to rabbits with creatinuria this symptom disappeared, as the urine became alkaline.

"The protein per se is without special significance in the phenomenon under discussion; for upon a diet consisting of oats, corn, and carrots creatin fails to appear in the urine, and the reaction of the latter remains alkaline. Equally significant is the further fact that the ingestion of hydrochloric acid with the mixed diet causes the appearance in the urine of significant quantities of creatin. Simultaneously, the hydrogen ion concentration of the urine is markedly increased.

"The conclusion seems justified that there is an interrelationship between acidosis and creatin elimination. Creatin in the urine may prove to be an index of a condition of acidosis in the organism."

II. *The influence of alkali upon creatin elimination during inanition.*—Data are reported regarding the influence of starvation upon the hydrogen ion concentration in the urine of laboratory animals (rabbits), and also the influence

of the administration of alkali upon creatin elimination during inanition. The results of the experiments are summarized as follows:

"Administration of alkali during the earlier days of starvation may greatly diminish or completely abolish the creatinuria of that condition. Later in the period of inanition introduction of alkali may not show as marked an influence upon the existing creatinuria. The results of these experiments lend support to the hypothesis that there exists a relationship between acidosis and creatin elimination."

III. *The influence of alkali upon the creatinuria of phlorizin glycosuria.*—The effect was studied of the administration of relatively large quantities of sodium bicarbonate upon the creatinuria in the case of phlorizinized dogs. The results obtained showed that "the administration of relatively large quantities of sodium bicarbonate is without appreciable influence upon the elimination of creatin during phlorizin glycosuria." This is true whether or not the animal is in a state of complete phlorizination. The authors conclude that more than one factor may govern the mechanism leading to creatinuria.

IV. *The relationship of creatinuria to carbohydrate metabolism and acidosis.*—The experiments reported in this paper were for the purpose of determining whether creatin may be excreted in the urine, under circumstances where carbohydrate depletion prevails, without an accompanying acidosis. A study was made of the creatinuria induced by hydrazin in the case of the dog as an example of such carbohydrate deficiency. The results of the experiments are summarized as follows:

"The subcutaneous administration of hydrazin to dogs induces a marked creatinuria which in general closely parallels the period of hypoglycemia provoked. These observations corrobate the results of previous investigations.

"During the period of hypoglycemia and most marked creatinuria the hydrogen ion concentration of the urine is greatly depressed—even to the point of marked alkalinity. The alkalinity is probably due to the presence of carbonates.

"The relationship of hypoglycemia and alkalosis again emphasizes the significance of acid-base equilibrium in the regulation of the blood sugar content.

"The results here presented make it evident that creatin elimination in the urine may be induced by at least two different sets of conditions: (1) Creatin may appear in the urine in states of acidosis where carbohydrate deficiency is not involved, and (2) creatinuria may be present during carbohydrate deficiency even in the absence of acidosis."

Alterations in the output of certain urinary constituents as determined by changes in the character of the diet, F. P. UNDERHILL and L. J. BOGERT (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 161–168*).—In view of the facts noted in the above investigation—that changes in the characteer of the diet may result in the appearance or the disappearance of creatin in the urine—experiments were carried out to determine whether these changes in the diet would result in changes in the output of other urinary constituents, consideration being given to the differences in intake of various components of the diet.

It was found that "upon a diet of corn and oats the output of phosphorus in the urine of rabbits is far in excess of the intake of this element in the food. Since the hydrogen ion concentration of the urine is very high under these circumstances, the great excess of phosphoric acid in the urine may be regarded as a method of regulating acid-base equilibrium in the body of the rabbit.

"Ammonia excretion is variable under changing conditions of diet, and although it appears that this base may function as a neutralizing agent at

times further experiments are necessary before the laws of ammonia excretion in the rabbit can be formulated. Calcium elimination is too variable to justify inferences being drawn under the experimental conditions.

"The results obtained indicate that the creatinuria observed upon a grain diet can not be explained upon the hypothesis of food insufficiency."

The volume of urine in young healthy adults on a constant diet, T. ADDIS and C. K. WATANABE (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 267–272*).—In connection with the above investigation a large amount of data was obtained regarding the volume of urine of subjects on a constant water intake, which are summarized as follows:

"The volume of urine in normal individuals on a constant diet with the same water intake is extremely variable for any single day or part of a day. The average volume of the last three days of the diet, when the water intake was 2,070 cc. varied in 20 individuals from 1,013 to 1,712 cc. for a 24-hour period, from 684 to 1,195 cc. for the first 12 hours of the day, and from 501 to 788 cc. for the first 8 hours of the day. The percentage of the 24-hour volume excreted during the 12 hours of the night did not exceed 47 per cent in any subject. . . .

"An increase of 1,000 cc. a day in the water intake more than doubled the volume of urine but did not appreciably increase the rate of urea excretion.

"An increase in the rate of urea excretion induced by the ingestion of urea, the water intake remaining constant, was accompanied by a considerable increase in the volume of urine."

The rate of urea excretion.—I, A criticism of Ambard and Weill's laws of urea excretion, T. ADDIS and C. K. WATANABE (*Jour. Biol. Chem., 24 (1916), No. 3, pp. 203–220*).—From a study of the relationship between the concentration of urea in the blood and the rate of urea excretion, when the concentration of urea in the urine is the same, and the relationship between the concentration of urea in the urine and the rate of urea excretion, when the concentration of urea in the blood is the same, the authors concluded as follows:

"The rate of urea excretion in man varies under physiological conditions in a manner which can not be explained by the concentrations of urea in the blood and urine. There is a tendency for an increased rate of urea excretion to exist with higher blood urea concentration in cases in which the urine concentration is the same, and for an increased rate of urea excretion to be accompanied by a lowering of the urea concentration in the urine in cases in which the blood concentration is the same. This relationship, however, is one which is frequently obscured, even in individuals under the same conditions as regards nitrogen and water intake. Other factors than urea concentration are important in determining the rate of urea excretion by the normal kidney."

The rate of urea excretion.—II, The rate of excretion of administered urea in young healthy adults on a constant diet, T. ADDIS and C. K. WATANABE (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 249–266*).—A study was made of the rate of excretion of urea administered to young, healthy adults who were on a constant diet, the aim being to obtain detailed information regarding the range of variation in the function of a normal kidney under normal conditions.

In 39 experiments no evidence of variability in kidney action was obtained in the work of excreting performed urea added to a constant diet. From this it is concluded that a normal kidney under constant conditions possesses a high degree of constancy of function.

"The rate of excretion of the administered urea during successive periods of the 24 hours showed that the repetition of large doses of urea did not elicit the condition which has been described as 'kidney fatigue.'

A fraction of the urea which was administered remained in the body after 24 hours. This urea was not retained because of any failure on the part of the kidneys to eliminate it, for the amount retained was no larger when 40 than when 20 gm. of urea were taken."

The interrelations of blood fat and blood sugar content of dogs under the influence of hydrazin, F. P. Underhill and E. J. Baumann (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 169–172*).—The object of this investigation was to determine the relation of the fat content to the sugar content of the blood in the case of laboratory animals (dogs) under the influence of hydrazin, which results in a low blood sugar content and the loss of glycogen from both the liver and muscles, and induces a so-called "fatty" liver.

The experiments showed that during the first days of fasting there was a tendency for the blood fat to decrease. This period was followed by one in which there was an increase of fat content up to approximately the initial value. During the interval of inanition studied there appeared to be little or no relation between the blood fat and blood sugar content.

"In hydrazin poisoning blood fat is markedly increased, the maximum being coincident with the condition of hypoglycemia characteristic of hydrazin. Blood fat returns to the fasting value as the sugar of the blood regains the normal."

The toxicity of carotin, H. G. Wells and O. F. Hedenburg (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 213–216*).—The authors describe the method of preparation from fresh carrots of the pigment carotin used in the experiments reported, in which the toxicity of carotin was determined in the case of laboratory animals (guinea pigs) given intraperitoneal and intradermic injections of the substance dissolved in olive oil. The doses of carotin injected were much larger than the amounts which can be obtained from any food, the larger doses being as much as that contained in 200 kg. of flour.

"These experiments indicate that even in relatively very large doses carotin, whether in its natural state or saturated with chlorin, is almost entirely devoid of toxicity. Such large amounts as 20 mg. injected intradermically cause only a local edema and inflammation, but no necrosis."

Clinical calorimetry.—XVIII, The number of places of significant figures in the data of metabolism experiments, F. C. Gephart, E. F. DuBois, and G. Lusk (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 217–223*).—Three factors are discussed as influencing the number of places of significant figures in the data. These are the accuracy of the analytical results, the possible errors in the methods of calculation, and the significance of the findings. It is concluded that the analytical error in metabolism work is seldom much less than 1 per cent and that a variation of 1 per cent in the results of an experiment would not change its significance or affect its interpretation.

"For these reasons, it seems unnecessary to publish more than three significant figures in the tables of data and in some cases it is not worth while to publish more than two. In order to avoid the accumulated rejection error it is advisable to retain four figures wherever possible in the calculations and reject the fourth digit only in the final result."

A table is given showing the number of places of significant figures adopted as standards in the publication of metabolism data.

For earlier work in this series see E. S. R., 35, p. 369.

ANIMAL PRODUCTION.

Meat situation in the United States.—V, Methods and cost of marketing live stock and meats, L. D. Hall, F. M. Simpson, and S. W. Doty (*U. S. Dept. Agr. Rpt. 113 (1916), pp. 98, pls. 20*).—In this fifth report of this series (E. S.

R., 35, p. 666) only those phases of the marketing of live stock and meats which bear most directly upon the economic aspects of the meat situation are considered. The report sets forth the results of studies recently conducted by the Office of Markets and Rural Organization, supplemented by data from other sources.

The objects in view in the investigations were to define and differentiate the principal methods by which live stock is marketed in the United States; to show the present relative importance of the several methods in the country at large and in the different States and agricultural regions; to analyze the more prominent items of cost involved in the various stages of the marketing of live stock and distribution of meats, with special reference to the reduction of cost through improvements in marketing methods and facilities; and to compare the margins or relative returns realized by each of the important classes of interests that participate in the movement of meat products from producers to consumers. The kinds of meat animals considered in the report are cattle, hogs, and sheep.

"Three general methods of marketing are open to producers of meat animals: First, through the large public stockyards and packing centers; second ,by means of local butchers and packers; and third, in the form of farm-prepared meats. . . . Estimates show that about one-half of the beef cattle, two-thirds of the hogs, and four-fifths of the sheep and lambs marketed pass through the large central markets; one-third of the beef cattle, one-twelfth of the hogs, and one-eighth of the sheep and lambs are sold for local slaughter; one-tenth of the beef cattle, one-third of the hogs, and one-twentieth of the sheep and lambs are slaughtered on farms and ranges. . . .

"In the United States relatively more sheep are shipped in carload lots by owners than any other class of live stock; cattle follow second, hogs third, and calves fourth. More hogs are marketed by local dealer-shippers than other classes of live stock, and calves, cattle, and sheep follow in the order named. . . .

"Cooperative live-stock shipping associations bring greater net returns to the farmer because of the reduction of marketing expenses and the realization of actual market prices. These associations also have educational features which are of importance to any community having live stock to market in small lots. . . .

"Direct marketing will remain an important factor in those parts of the country remote from centralized markets. . . .

"Average freight rates on live stock for the years 1911–1913 were 10 cts. per hundredweight for eastern or official territory, 11.9 cts. for southern territory, and 14.9 cts. for western territory. Replies to inquiries show that train service is satisfactory in a majority of cases. The total claims for live stock loss and damage in transit on 27 railroads amounted to $1,245,477.81 during the fiscal year 1913–14. . . .

"The largest single factor in the marketing of meat animals in the United States is the system of centralized live-stock markets. These markets not only are a medium through which live stock is sold for slaughter, but a large proportion of stocker and feeder cattle also passes through them. The terminal charge at most centralized markets is $2 per car. Yardage is 25 cts. a head on cattle, 10 cts. on calves, 8 cts. on hogs, and 5 cts. on sheep at a majority of the markets. Commission charges are 60 cts. per head on cattle, 25 cts. on calves, 20 cts. on hogs, and 10 cts. on sheep at most markets.

"Wholesale slaughtering and meat packing constitute the chief outlet for market stock suitable for slaughter. The most extensive development of meat

packing is found at Chicago and Missouri River points. . . . Public abattoirs have been established in 22 cities in 13 States. Seven of these establishments are owned and operated by the city, while the remaining 15 are owned privately and operated under city inspection. Local packing houses are distributed mainly in the more important live-stock producing States and in sections remote from live-stock markets and packing-house centers. Cooperative packing houses recently have been promoted in a number of communities in six States. . . .

"The marketing of farm-prepared meats, although comparatively limited in relation to the industry as a whole, is practiced more or less in almost all parts of the country. The curing of meat at ice plants is a recent development in local marketing in the South. . . . The parcel-post method of marketing meat is limited in comparison with the other methods, yet the amount thus marketed is considerable as a sum total.

"The correlation between average live-stock and meat prices is closer than generally is understood. Daily fluctuations in live-stock quotations frequently are large and abrupt and constitute one of the most adverse features of live-stock market conditions. Meat prices from day to day tend to follow general averages of previous years more closely. The results of investigations of the marketing of 9 lots of cattle through centralized markets show that from 54 to 85 per cent of the gross returns was received by the stockmen, from 2 to 5 per cent was absorbed by marketing expenses, 2 to 9 per cent was received gross by packers, and 8 to 33 per cent by retailers. The retailers' gross margin, as shown from the results of marketing locally five shipments of cattle, varied from 15 to 38 per cent of the gross returns. From 62 to 84 per cent of the gross returns on these cattle was received by the owner."

The marketing of live stock, D. A. GAUMNITZ (*South St. Paul, Minn.: W. M. Campbell Commission Co., 1916, pp. 42*).—This treats of methods of marketing live stock, preparing animals for shipment, loading, feeding in transit, and other related topics.

On the general theory of multiple contingency with special reference to partial contingency, K. PEARSON (*Biometrika, 11 (1916), No. 3, pp. 145–158*).—A mathematical discussion of the theories of multiple and partial contingency, in which a large number of formulas are set forth.

On certain probable errors and correlation coefficients of multiple frequency distributions with skew regression, L. ISSERLIS (*Biometrika, 11 (1916), No. 3, pp. 185–190*).—Formulas are given for use in the systematic investigation of statistical constants of multiple correlation and of their probable errors in cases in which skew regression is involved.

On the probable error of a coefficient of contingency without approximation, A. W. YOUNG and K. PEARSON (*Biometrika, 11 (1916), No. 3, pp. 215–230*).—In this paper the authors consider the variation of ϕ^2 on the hypothesis of Pearson [1] but without approximation.

On some novel properties of partial and multiple correlation coefficients in a universe of manifold characteristics, K. PEARSON (*Biometrika, 11 (1916), No. 3, pp. 231–238*).—The object of this paper, which is of interest to statisticians and biometricians, is to show by direct determinantal analysis certain relations known and unknown between the higher multiple and partial correlation coefficients.

On the application of "goodness of fit" tables to test regression curves and theoretical curves used to describe observational or experimental data, K. PEARSON (*Biometrika, 11 (1916), No. 3, pp. 239–261, fig. 1*).—This is a discussion of the "goodness of fit" and its application in statistics and physics.

[1] Biometrika, 10 (1914), p. 570.

On the "best" values of the constants in frequency distributions, KIRSTINE SMITH (*Biometrika, 11 (1916), No. 3, pp. 262–276, figs. 2*).—This is a comparison of the methods of moments and least squares in determining the values of constants in frequency distributions. It is concluded that if the definition of the "best" is made somewhat arbitrary the use of the method of moments is justified.

Berseem as a forage plant, J. B. PIOT (*Bul. Union Agr. Égypte, 14 (1916), No. 114, pp. 14–22, fig. 1*).—Successful experiments are reported in feeding berseem, or Egyptian clover, to cattle in Egypt, resulting in material gains.

Silos and silage, E. W. SHEETS (*West Virginia Sta. Bul. 157 (1916), pp. 313, figs. 4*).—Notes are given on the advantages of silage, the essential features of a good silo, dimensions of silo to build, and types of silos in the State.

Unpublished experiments at the station have shown that in wintering steers wheat straw and cottonseed meal are superior to timothy hay as supplements to silage. The cost of producing silage in different parts of the State was found to vary from $23.43 to $35.60 per acre while the yields varied from 10 to 10.3 tons per acre. The cost of producing timothy or mixed hay varied from $7.04 to $8.35 per acre, and the yields from 1.2 to 1.3 tons per acre. It is stated that the greatest value of silage is that it reduces to one-third the crop land necessary to feed or winter a given number of animals.

Pea-cannery refuse, M. ROSBY (*Country Gent., 81 (1916), No. 30, p. 1403, fig. 1*).—A general discussion of the feeding value of pea-cannery refuse. The vines may be preserved either by stacking or by ensiling. It is stated that pea-vine silage is superior in some ways to corn silage, being higher in protein content and but slightly lower in carbohydrate content. Excellent results have been secured in feeding this silage to sheep, a rapid growth and fine quality of mutton being claimed.

Commercial feeding stuffs and registrations for 1916, C. S. CATHCART ET AL. (*New Jersey Stas. Bul. 295 (1916), pp. 95*).—Tabulated results are given of analyses of 1,102 samples of feeding stuffs inspected during 1915, including alfalfa meal, blood meal, brewers' dried grains, buckwheat feed, buckwheat middlings. buckwheat offal, coconut meal, copra cake meal, cottonseed meal, corn bran, corn meal, gluten feed, gluten meal, corn and cob meal, distillers' grains, dried beet pulp, feeding flour, fish scrap, hominy meal and feed, linseed meal, malt sprouts, meat scrap, oat hulls, peanut meal, rye bran, rye feed, rye middlings, screenings, wheat bran, wheat feed, wheat middlings, and mixed and proprietary feeds. A list of manufacturers who have registered feeding stuffs for sale during 1916 is included.

[Animal husbandry work] (*Kansas Sta. Rpt. 1915, pp. 34–38*).—At the Fort Hays substation during the winter of 1914–15 100 high-grade yearling heifers were wintered in four different lots to determine the comparative value of Sudan hay, Kafir corn stover, damaged alfalfa, and sorghum butts. The animals had access to wheat straw at all times. All of the feeds proved to be satisfactory roughages when fed in connection with a small amount of linseed meal. The cost of wintering for 120 days varied from an average of $6.84 to $7.53 per head for the different lots.

During the same winter 64 mature beef cows were fed Kafir corn silage, Kafir corn butts, wheat straw, and alfalfa hay supplemented with linseed meal or cottonseed cake. The average cost per head for wintering these cows was $8.36 and they furnished a market for a large amount of feed which would otherwise have gone to waste.

Two lots of 30 high-grade Hereford heifer calves each were placed on an experiment in the fall of 1913. One of these lots was so fed as to produce a maximum growth and the other lot was maintained in ordinary range condition. At

the close of the second year's feeding there was a difference of 53 lbs. in the average weight of the heifers maintained in range condition as compared with those that had been wintered under more nearly ideal conditions. The average cost of this additional growth was $6.97 per head.

The results of a feeding experiment with pigs during the winter of 1914–15 indicate that corn is slightly superior to any of the grain sorghums, its use resulting in more rapid gains and a higher finish. There was very little difference between the value of Kafir corn, feterita, and milo maize. Kaoliang did not prove to be very palatable. The feeding of whole threshed Kafir corn resulted in a great waste of feed, while the feeding of Kafir corn in the head proved to be advisable where facilities for grinding it are not present on the farm.

Inheritance of color and horns in blue-gray cattle, O. Lloyd-Jones and J. Evvard (*Iowa Sta. Research Bul. 30 (1916), pp. 67a–106a, figs. 10*).—Data that have accumulated for 13 years at the Iowa Station on color and horn inheritance in crosses between Galloway and Shorthorn cattle are presented. Preliminary reports of progress have been reported by E. N. Wentworth (E. S. R., 28, p. 572).

A detailed discussion is offered of the color and polled or horned condition as seen in the parent breeds and the offspring resulting from the crosses in these experiments, together with suggestions as to the genetic relationship as to these characters.

Since 1906 when the inheritance studies reported were undertaken 24 dams as follows have been used: Four Shorthorns, 5 F_1 blue-gray (from white Shorthorn bull × Galloway cows), 3 Galloways, and 12 others of various generations and descriptions. The sires in use have been a blue-gray polled F_1 (from white Shorthorn bull × Galloway cow), a red polled F_2, and red, roan, and white Shorthorn bulls. In all, 71 calves have been produced which are included in the present work.

The authors conclude that "the nature of black and red pigment in cattle as an independent allelomorphic pair of characters is clearly indicated. White animals appear to be the result of pigment in a restricted condition, due to the absence of the factor *E* for extension. The restricted pigment may be either black or red in color. No extracted animal white with red ears has yet appeared. The whites with black ears, a novelty in this experiment, are similar in pattern to the Park Cattle of Britain, but it is doubtful if they can be considered genetically comparable to them.

"A satisfactory explanation of the genetics of roan color in cattle has not yet been made. A roan-producing factor *N* has been tentatively assumed to exist, but the results secured from these experimental matings agree almost equally well with the interpretation of roan as a heterozygote between white and colored. This would make the factor *N* unnecessary, for the roan condition would appear in all animals that were heterozygous for extension, that is *Ee*, without the aid of any other factor.

"The published data on the inheritance of horns in cattle are reviewed and new data presented. The present results substantiate the allelomorphic nature of the horned and polled condition in cattle, and give no evidence that sex is in any way connected with the inheritance of these characters."

A bibliography is included.

Feeding range steers, L. Foster and H. H. Simpson (*New Mexico Sta. Bul. 101 (1916), pp. 24, figs. 10*).—This bulletin gives the results of feeding experiments conducted in 1909 and 1910 with range steers.

In the first experiment, which lasted 91 days from January 8, 1909, a comparison was made of the feeding values of barley, corn, and Kafir corn, each

being supplemented with 2 lbs. cottonseed meal daily. A comparison was also made in this test of corn stover and Kafir corn stover for replacing a part of a roughage ration of alfalfa. Five lots of 5 high-grade Hereford and Shorthorn yearling range steers, averaging about 600 lbs. each in weight at the beginning of the test, were used. In the second test, which lasted 90 days from January 19, 1910, the effort was made to find the most economical method of fattening range steers under New Mexico conditions, with home-grown feeds or with those most readily available. In this test there were 4 lots of 5 high-grade Hereford and Shorthorn yearling steers, each averaging about 200 lbs. lighter per steer than those in the 1909 test.

The rations compared and some of the results obtained are given in the following table:

Steer feeding tests.

Year.	Variable portion of daily ration.	Average daily gain per head.	Cost of feed per pound of gain.	Profit per steer.
		Pounds.	*Cents.*	
1909	20 pounds alfalfa hay, 8 pounds barley	2.04	9.52	$9.62
1909	20 pounds alfalfa hay, 8 pounds corn	2.11	9.32	9.91
1909	20 pounds alfalfa hay, 8 pounds Kafir corn	1.95	9.90	9.07
1909	10 pounds alfalfa hay, 10 pounds shredded corn stover, 8 pounds Kafir corn	2.01	9.25	10.15
1909	10 pounds alfalfa hay, 10 pounds shredded Kafir corn stover, 8 pounds Kafir corn	1.84	10.47	8.39
1910	Alfalfa hay, corn stover, ad lib	1.39	3.98	6.93
1910	Alfalfa hay, ad lib	1.84	4.14	8.30
1910	Alfalfa hay, ad lib., 8 pounds corn	2.58	5.99	6.58
1910	Alfalfa hay, ad lib., 10 pounds corn (last 30 days only)	2.06	5.01	7.44

The corn, barley, and Kafir corn in all the rations were ground. The feeds used in the experiments were estimated at the following prices: Ground corn, Kafir corn, and barley $30 per ton; cottonseed meal, $35 per ton; alfalfa hay, $10 per ton; shredded corn stover and Kafir corn stover, $6 per ton. The initial value of the steers per pound was 5.9 cts. in 1909 and 7.49 cts. in 1910, and the selling value in each case 8 cts.

In the 1909 experiment the steers rejected an average of 2.5 per cent of the alfalfa hay, 26.8 per cent of the corn stover, and 18.9 per cent of the Kafir corn stover.

Pasturing sheep on alfalfa, B. AUNE (*U. S. Dept. Agr., Bur. Plant Indus., Work Belle Fourche Expt. Farm, 1915, p. 14, fig. 1*).—Beginning August 28, 1915, 10 lambs with an average weight of 75 lbs. each were pastured for 40 days on a 1-acre field of third-crop alfalfa. The pasture was divided into two lots, which were pastured alternately. During this time the lambs made an average gain of 0.39 lb. each per day, so that, with the gains worth 7 cts. a pound, a return of $10.85 per acre was secured for 40 days' use of the alfalfa pasture. No bloating occurred.

Sheep feeding experiment (*Kansas Sta. Rpt. 1915, pp. 25, 26*).—Results are given of a feeding experiment which lasted from October 30 to December 20, 1914, with 313 western range lambs to determine the comparative value (1) of corn and Kafir corn as grain, (2) of alfalfa and cowpea hay as roughage, (3) of sorghum as silage or hay, and (4) of ground *v.* unground Kafir corn.

The lambs, which averaged about 55 lbs. each, were divided into six lots and so fed as to make a maximum use of the roughage. Daily rations, in addition to 0.19 lb. of cottonseed meal per lamb which was given to all the

lots, and some of the results of the experiment, are given in the following table:

Lamb feeding experiments with different rations.

Lot.	Variable portion of ration per lamb.	Average daily gain.	Cost per pound of gain.	Final value per pound.	Average profit per lamb.
		Pounds.	*Cents.*	*Cents.*	
1	0.89 pound corn, 1.35 pounds alfalfa hay, 1.09 pounds sorghum silage	0.40	5.60	8.05	$1.02
2	0.9 pound corn, 1.53 pounds cowpea hay, 1.09 pounds sorghum silage	.35	6.19	8.05	.82
3	0.9 pound corn, 1.36 pounds alfalfa hay, 0.43 pound sorghum hay	.39	5.52	8.00	.99
4	0.9 pound corn, 1.78 pounds alfalfa hay	.39	5.73	7.90	.86
5	0.9 pound Kafir corn, 1.36 pounds alfalfa hay, 1.09 pounds sorghum silage	.35	6.03	7.90	.73
6	0.9 pound ground Kafir corn, 1.36 pounds alfalfa hay, 1.09 pounds sorghum sliage	.36	6.18	8.05	.84

In figuring the cost of gains and profits the feeding stuffs were priced as follows per ton: Shelled corn, $25; Kafir corn, $22; ground Kafir corn, $24; cottonseed meal, $26; alfalfa hay, $10; cowpeas, $8; sorghum hay, $6; and sweet sorghum silage, $4. The lambs cost 7.3 cts. per pound delivered at the station, and the final values per pound in the above table are 0.6 ct. per pound lower than market prices to cover the expense of shipping to market.

[Feeding experiments with lambs] (*California Sta. Rpt. 1916, pp. 53, 55*).—In a comparison of spineless cactus and corn silage for fattening lambs, F. W. Woll found that the silage produced 17 per cent more gain with 10 per cent less feed than the cactus ration. It required about 10 days to get the lambs to eat the cactus readily.

In a test in which 125 lambs were allowed to graze upon a barley stubble field at the rate of 1 lamb per acre for a period of five weeks, R. F. Miller found that they made an average gain of 11 lbs. each, making the stubble field worth about 75 cts. per acre. The barley yielded 25 sacks per acre, and had been harvested with a combined harvester.

These lambs were then separated into lots in a feed lot and fed barley and alfalfa hay as a basal ration, supplemented with cottonseed meal, coconut meal, alfalfa meal, and molasses, respectively, one lot being fed a commercial feed, alfalfa meal, and molasses alone. The coconut-meal lot made the most economical gains, the cottonseed-meal lot being next. Alfalfa meal and molasses proved to be an expensive feed at $18 per ton.

In another experiment with lambs, corn silage, milo maize silage, and sweet sorghum silage as supplements to alfalfa hay and barley were compared, and one lot was fed alfalfa hay alone. In economy of gain the ration containing milo maize silage ranked first and that containing sorghum silage second. The alfalfa hay lot made only about one-half the gains that the other lots made.

The use of hogs in disposing of crops, F. Knorr (*U. S. Dept. Agr., Bur. Plant Indus., Work Scottsbluff Expt. Farm, 1915, pp. 12, 13*).—Continuing previous work (E. S. R., 34, p. 228), during the season of 1915 hogs were pastured on alfalfa from early spring until September, being fed a supplemental ration of 2 lbs. of corn per 100 lbs. of live weight. They made gains of 2,976 lbs. per acre of pasturage and consumed 2.53 lbs. of corn per pound of gain. Valuing the gains at 7 cts. per pound and the corn at 60 cts. per bushel, there was a net return of $132.84 per acre for the season, an equivalent of $29.54 a ton for the 1915 alfalfa hay crop. The three-year average has been $24.40 per ton.

Corn plats hogged down in 1915 produced a gain of 212 lbs. of pork, live weight, per acre, as compared with 1,052 lbs. in 1914, 1,008 lbs. in 1913, and 628 lbs. in 1912. The low gains in 1915 were due to the fact that the corn plats were severely damaged by hail.

[Pasturing alfalfa and corn with hogs], B. AUNE (*U. S. Dept. Agr., Bur. Plant Indus., Work Belle Fourche Expt. Farm, 1915, pp. 11–14*).—Continuing experiments previously noted (E. S. R., 33, p. 871), one lot of fall pigs grazing on alfalfa, and also fed during the pasture season 4,787 lbs. of corn per acre of alfalfa, gave a net return per acre in 1915 of $60.32. Another lot of pigs, fed 4,976 lbs. of corn per acre of alfalfa, gave a net return of $62.97 per acre of alfalfa grazed. In these two tests it took 2.36 lbs. of corn to produce 1 lb. of gain. The corn was charged at $1.70 per 100 lbs., and a value of 7 cts. per pound was given to the pigs.

In hogging down corn, one plat with an estimated yield of 40.6 bu. of corn per acre produced pork at the rate of 548 lbs. live weight per acre. Another plat with an estimated yield of 34 bu. of corn per acre produced pork at the rate of 451 lbs. live weight per acre.

[Pasturing alfalfa and corn with hogs], D. HANSEN (*U. S. Dept. Agr., Bur. Plant Indus., Work Huntley Expt. Farm, 1915, pp. 9–11, fig. 1*).—Continuing previous experiments (E. S. R., 33, p. 429), hogs pastured on alfalfa in 1915 gave a return of $75.88 per acre during the pasturing season, an equivalent of $10.84 per ton for the alfalfa hay crop. In this test the hogs were given a supplemental ration of 2 lbs. of corn per 100 lbs. of live weight.

Corn with an estimated yield of 52.41 bu. per acre when hogged down produced 864 lbs. of pork, live weight, per acre. The hogs consumed 3.4 lbs. of corn per pound of gain and made an average daily gain per head of 2.16 lbs.

[Feeding experiments with pigs], J. I. THOMPSON (*California Sta. Rpt. 1916, p. 55*).—In experiments in which wheat shorts, coconut meal, tankage, and cull beans were fed in conjunction with alfalfa pasture, self-feeders proved superior to hand-feeding. Coconut meal was an economical supplement to barley, but produced severe scouring when fed in considerable amounts. Cooked culled beans produced cheap gains, but a soft low-dressing product.

In a test in which the effects of feeding raisins to swine were studied 3 lots of 8 5-months' old pigs were fed raisins, raisins and barley, or barley alone, respectively, alfalfa meal being fed, in addition, to each lot. When constituting the entire concentrated part of the ration, raisins produced slow gains and considerable scouring resulted. When barley and raisins were fed in equal parts the raisins showed nearly the same feeding value as barley.

The physiological effect upon work horses of alfalfa hay cut at different stages of growth (*Kansas Sta. Rpt. 1915, pp. 16, 17*).—This is a brief report of one year's work in an investigation undertaken in 1914 to determine (1) the effect upon stand and yield when alfalfa is harvested at different stages of growth; (2) the variation in the amount of total nutrients and fertility elements in the hay cut at different stages of growth; and (3) the physiological effect upon horses fed the different alfalfa hays.

The largest yield was obtained from the alfalfa cut at the time of bud formation, and each successive stage gave a smaller yield. No effect on the stand was noticed this first year. The alfalfa cut in the bud stage had the largest percentage of ash and crude protein and the smallest percentage of crude fiber and nitrogen-free extract; the first two decreased in each successive stage, and the last two increased. It also gave the largest total yield of all nutrients per acre. It had the largest percentage of nitrogen, phosphorous, and potassium, and all these decreased in the successive stages. The alfalfa hay

cured in the sun had a larger percentage of pure protein than that cured in the shade.

In feeding the different alfalfa hays to horses no material difference in physiological effect was noticed.

Growing draft colts, C. W. McCampbell (*Kansas Sta. Rpt. 1915, pp. 54–69, figs. 16*).—An experiment was started in January, 1913, the objects of which were to determine (1) whether the good draft colts can be grown without the use of oats, (2) the cost of developing draft colts under ordinary Kansas conditions, and (3) the type of colt which usually develops into the largest horse.

The results of the experiment show that "the colts receiving a grain ration of 70 per cent of corn, 25 per cent of bran, and 5 per cent of oil meal made a daily growth of 1.023 lbs. during the entire period of 720 days, while the colts receiving oats made a daily growth of only 0.926 lb. Each pound of growth during the entire period made by the colts receiving corn, bran, and oil meal cost 15.04 cts., while each pound made by the colts receiving oats cost 18.6 cts.

"The colts made more rapid growth during the first year after weaning than during the second year. The first year's daily growth averaged 1.285 lbs. and the second year's daily growth 0.7 lb. Although the total cost of feeds consumed during the first year was greater than that during the second year, the growth was cheaper. The average cost of each pound of growth during the first year was 14.2 cts., and during the second year 23 cts.

"The average total cost of developing the grade colts from the time they were approximately eight months old until they were ready to work (2.5 years) was $123.37. The cost of raising a draft colt to the age of eight months is about $50, making the total cost (including the labor) until the colt is ready to work approximately $175, under conditions and prices similar to those of 1913–1914.

"The colts showing considerable bone and stretch at weaning time developed into the largest horses. The plump, mature-looking weanlings are still plump little horses."

Philippine horses, D. B. Mackie (*Jour. Heredity, 7 (1916), No. 8, pp. 373–382, figs. 4*).—The author maintains that the Philippine horse is not, as popularly supposed, a descendant of horses brought to the islands from Mexico and Spain by the Spaniards, but that the bulk of the animals brought in by the early colonists were Chinese. It is shown that horses existed in parts of the archipelago prior to the Spanish conquest, and the ancestry of these is traced to Malaysia. In addition to China other channels hitherto almost unknown have poured equine blood into the Philippines, so that the horses of the islands to-day contain large or small amounts of characters from Chinese, Japanese, Mexican (including various races entering into the race so designated), Persian, Indian, and Sumatran sources.

[Poultry investigations], J. E. Dougherty (*California Sta. Rpt. 1916, p. 58*).—Continuing experiments with high-protein animal and vegetable feeds (E. S. R., 34, p. 268), the results to date indicate that it makes little difference what kinds of such feeds are fed so long as the ration contains some animal feed, has an approximately correct nutritive ratio, and contains feeds suitable to poultry.

It was found to be economical to use some animal feed in the ration, but mashes containing as low as 7.7 per cent meat scrap gave us good results as those containing much higher percentages. Where fowls had free access at all times to hoppers of meat scrap and soy bean meal in addition to the basic mash, they ate 10.55 lbs. of meat scrap and 12.7 lbs. of soy-bean meal per hen per year, as compared with 1.8 to 3.6 lbs. of soy-bean meal and meat scrap, respectively, in other pens where the animal and vegetable high-protein feeds

were mixed in varying proportions with the mash. Yet the fowls consuming the greater amounts of high-protein feeds laid no better. This would indicate that fowls can not be trusted to balance their ration.

[Poultry investigations] (*Massachusetts Sta. Rpt. 1915, pt. 1, pp. 29a, 30a, 48a–50a*).—From investigations connected with the factors which influence egg production H. D. Goodale concludes that the prime factor essential for satisfactory winter egg production from strong stock is early maturity. The records of the station flocks show that, even in the case of birds of one breed hatched from eggs from the same pen supposedly made up of birds of similar breeding, the age at which the first egg is produced varied from 195 to 300 days. The prime factor essential for high egg production, aside from early maturity, was found to be nonbroodiness. Data show that when a hen becomes broody her egg production decreases about 40 per cent. The effort is being made to develop a nonbroody strain of Rhode Island Red hens.

The work of the year indicates that chicks reared on new land thrive better than those raised on land upon which chicks have previously ranged, even if for only a short period of time.

DAIRY FARMING—DAIRYING.

[Dairy husbandry studies], F. W. Woll (*California Sta. Rpt. 1916, pp. 52, 53*).—Confirming results already noted (E. S. R., 34, p. 269), data obtained during the year indicate that the feeding of barley does not tend to reduce milk flow. It was found, however, that most cows do not do so well on barley alone as on mixed grain rations.

Heifers fed alfalfa and mixed rations dropped somewhat heavier calves and produced during their first lactation period a marked increase in milk and milk fat as compared with heifers fed alfalfa only.

In an experiment with spineless cactus for milch cows, the amounts of the cactus that the cows could be induced to eat were so small that the nutrients supplied formed only an insignificant part of the rations. Analyses are given of the cactus slabs.

Carrying capacity [of irrigated pastures], D. Hansen (*U. S. Dept. Agr., Bur. Plant Indus., Work Huntley Expt. Farm, 1915, pp. 14–16, figs. 2*).—Two milch cows were pastured for 164 days in 1915 on three-quarters of an acre of mixed grass irrigated pasture (E. S. R., 33, p. 429), during which time they were given 882 lbs. of grain and 1,630 lbs. of alfalfa hay as supplemental feed. During this time they produced 5,247 lbs. of milk and 213.7 lbs. of milk fat. Valuing the alfalfa hay at $6 per ton, grain at $25 per ton, and the 213.7 lbs. of milk fat at $52.07, there was a return of $48.20 per acre for the pasture.

In testing the value of irrigated pastures during the first year after seeding a quarter-acre plat was seeded without a nurse crop during the spring of 1915 with a mixture of awnless brome grass, orchard grass, meadow fescue, Kentucky bluegrass, perennial rye grass, tall fescue, and white clover. During the latter part of the season this plat furnished abundant grazing for one heifer for 58 days, during which time a gain of 114 lbs. was made, an equivalent at 5 cts. per pound of gain of $22.80 per acre for the pasture. No bad effects of the early grazing upon the grasses were apparent at the close of the season.

The cost of producing goat milk, E. C. Voorhies (*California Sta. Rpt. 1916, pp. 52, 53*).—Two young purebred Toggenburg milch goats produced during the past year 1,553.2 lbs. of milk containing 45.01 lbs. of fat, and 1,341.6 lbs. of milk containing 38.67 lbs. of fat, respectively. The cost of feed eaten by the goats during the year at ordinary market prices amounted to $12.64 and $10.71,

respectively, making the feed cost per gallon of milk 6.8 cts. and 6.9 cts. for the two goats.

Further studies of the relation of the quality of proteins to milk production, E. B. Hart, G. C. Humphrey, and A. A. Schaal (*Jour. Biol. Chem., 26 (1916), No. 2, pp. 457–471, figs. 4*).—Continuing the study previously noted (E. S. R., 33, p. 275), data on the comparative value for milk production of the proteins of gluten feed, oil meal, distillers' grains, casein, and skim-milk powder are reported. Fifty per cent of the total digestible proteins of the ration was furnished by these concentrates, which were used to supplement a basal ration of corn stover, corn silage, and corn meal. The total protein intake constituted about 10 per cent of the dry matter of the ration, and the nutritive ratio was approximately 1:8.

"With a daily production of 40 to 45 lbs. of milk carrying 10 to 12 per cent of total solids, negative nitrogen balance persisted throughout the experiment of 16 weeks' duration. Only during the period of skim-milk powder feeding was one of the animals storing nitrogen. In spite of this long negative balance milk secretion continued at the expense of catabolizing tissue. The total yield and total solids of the milk declined slightly after two months of continuous negative nitrogen balance."

A marked difference in the utilization of the concentrates was observed, gluten feed showing a percentage efficiency of 45, oil meal 61, distillers' grains 60, casein 59, and skim-milk powder 60. These data represent the efficiency in the mixture used.

"Possible errors in calculation may arise from the supplementing effect of the catabolizing tissue, thereby raising the figures above their true value, but nevertheless they do have comparative worth. Other roughages will be used in a further study of this problem.

"These studies furnish additional evidence that the nutritive ratio or plane of protein intake for milk production may vary according to the nature of the concentrates and basal ration used."

Cooling hot-bottled pasteurized milk by forced air, S. H. Ayers, J. T. Bowen, and W. T. Johnson, Jr. (*U. S. Dept. Agr. Bul. 420 (1916), pp. 38, figs. 20*).—In continuation of investigations previously noted (E. S. R., 31, p. 275), experiments are reported the object of which was to ascertain whether hot-bottled pasteurized milk can be successfully cooled by forced air under commercial conditions. Data are also given on the heating of cold-bottled milk by means of circulated hot air.

The cooling experiments were conducted on a 30-crate basis, 15 for quart bottles and 15 for pints, with a specially designed experimental apparatus which is illustrated and described. A description is also given of the instruments and method of recording data. On account of the small variation in the relative rate of the cooling of water and milk, water was mainly used in these experiments. Bottles of milk were distributed throughout the crates, however, for bacteriological studies as well as for temperature readings. Temperature readings were also taken in the bottles of water.

To compare the rate of cooling bottles and cans containing milk when exposed to still air and to moving air, pint and quart bottles and 10-gallon cans of milk were placed in a refrigerated room, the temperature of which was held at about 40° F. In still air it required 4½ hours to reduce the temperature of milk in pint bottles from 142 to 50°, while in circulating air, where the air was forced in a horizontal direction over the containers at a velocity of 1,250 ft. per minute and at a temperature of about 40°, the corresponding time required was 1 hour and 27 minutes. With quart bottles of milk under the same conditions the

relative rate of cooling for bottles exposed to still air and moving air was the same as that for pint bottles, but the time required for cooling through the above range was longer. In a room temperature of 42° milk in the 10-gallon cans was reduced from 147 to 90° in 6½ hours in still air and in 2 hours and 15 minutes in moving air.

In cooling experiments performed on a 30-crate basis in which the air was forced from the bottom upward, it was found that the variation in temperature in different sized bottles and the same sized bottles at different positions in the stack was too great for satisfactory commercial operation. Consequently in the next experiments the direction of the air through the stack was reversed periodically, the cold air being blown through from the bottom for 15 minutes and then through from the top for the same period. It was found that while the difference in temperature between the top and bottom bottles was decreased to a certain extent by reversing the air, still there was too great a difference for satisfactory operation commercially.

In experiments in which the air was forced from the top downward it required 2 hours and 10 minutes to reduce the temperature of the lower quarts to 50° when the temperature of the incoming air was 40°; 1 hour and 35 minutes when the temperature of the incoming air was 30°; and 1 hour and 20 minutes when the temperature of the incoming air was 20°. In these experiments with the incoming air temperature at 40° the average difference in temperature between the lower quart and upper pint at the end of the cooling period was 8.9°, and with the incoming air at 30° the average difference was 2.49° and maximum difference 4.5°.

When a bottle was cooled by an air blast from the bottom of the stack there was a difference in temperature between the top and bottom of the bottle of about 8° when the fan was started and 23° 22 minutes later. When the air was forced downward through the crate of bottles this difference between the top and bottom of individual bottles was practically eliminated.

In experiments on the cost of cooling by means of cold outside air it was found that under the conditions of the experiments and assuming a cost of 6 cts. per kilowatt hour for electric energy, the cost of power per ton of refrigeration was $1.11. Under commercial conditions it is estimated that the cost would be only about 66 cts. per ton of refrigeration. These figures are based on an outside air temperature of 40° or lower.

In order to obtain data on the effect of slow cooling on the bacterial content of milk after pasteurization, ten experiments made in which milk was first pasteurized and bottled hot in steamed bottles. For the ten bottles cooled within one-half hour in ice water the average number of bacteria per cubic centimeter was, directly after pasteurization, 5,823; after 17½ hours in the refrigerator at 45°, 5,040; and taken from the refrigerator 18 hours after pasteurization and held for 6 hours at 75 to 86°, 6,908. For the ten bottles of milk cooled slowly at room temperature for four hours the average number of bacteria per cubic centimeter was, directly after pasteurization, 5,727; after 14 hours in the refrigerator at 45°, 4,678; and taken from the refrigerator 18 hours after refrigeration and held for 6 hours at 75 to 86°, 5,583. The average bacterial content of the ten samples of raw milk in this experiment was 264,375 per cubic centimeter. On checking these results in a test with pasteurized milk cooled on a small commercial scale it was found that when the bacterial content of raw milk was high there was a marked reduction in the number of bacteria during the process of cooling by forced air circulation. However, the authors state that the period of cooling to 50° should not exceed five hours.

and to provide a wide margin of safety they recommend that the milk be cooled within 3 hours after it is bottled.

In laboratory experiments on a 30-crate basis it was found that slow cooling of hot-bottled pasteurized milk had no detrimental effect on the cream line and the flavor of the milk. In these experiments the milk was pasteurized at 145° and the cooling period was not longer than three hours.

In experiments upon heating bottled milk by means of forced air it was found that the pint and quart bottles in similar positions and the same sized bottles in different positions in the stacks were heated unevenly. It was impossible to heat the bottles to the pasteurizing temperature of 145° without overheating some of them. The experimental apparatus used in heating the milk in bottles by means of circulated hot air is illustrated and described.

Grading and labeling of milk and cream (*Boston: Boston Chamber Com., 1916, pp. 24, figs. 44*).—This pamphlet describes the system of grading and labeling milk and cream in use in various cities in the United States, and contains suggestions for grading and labeling. Notes are also given on standardization and systems of buying milk.

Butter making, L. M. Davis (*California Sta. Rpt. 1916, p. 48*).—Butter kept in cold storage for three months showed a shrinkage of 0.6 per cent. Soaking parchment wrappers in a strong salt ($NaCl$) solution for several hours before using generally prevented moldy growth in butter, due to contamination from wrappers.

It was found that mold does not grow in butter containing 2 per cent or more of salt. It is stated that a good grade of butter can be made from cream possessing a minimum butter fat standard of 35 per cent and an acidity of 0.45 per cent from May to November, and 0.35 per cent from November to May, unless the cream is of bad flavor.

Cheese making, H. S. Baird (*California Sta. Rpt. 1916, p. 48*).—It was found more difficult to make a good grade of cheese from milk produced under ordinary conditions during the summer months than during the spring and late winter months, even where uniform methods prevail. Attempts to prevent mold growth on cheese held in a poorly ventilated refrigerating room by washing the cheese, walls, and shelves with a solution of corrosive sublimate and fumigating the room by burning sulphur were unsuccessful. Artificial circulation of air by means of a fan checked the growth of mold to some extent.

The manufacture of cheeses with a definite fat content in the dry substance, K. Windisch (*Württemb. Wchnbl. Landw., 1916, Nos. 9, pp. 146, 147; 10, pp. 160, 161*).—This article discusses the preparation of various kinds of cheese with a definite fat content in the dry matter of the finished product by regulating the fat content of the kettle milk.

The following formulas for mixing a kettle milk of any desired fat content are submitted:

$$x=\frac{100\,(k-m)}{v-k};\ y=\frac{100\,(v-k)}{k-m};$$

v=fat content of the whole milk; m=fat content of the skim milk; k=the desired fat content of the kettle milk; x=liters of whole milk which must be added to 100 liters of skim milk to obtain the kettle milk of desired fat content; and y=liters of skim milk which must be added to 100 liters of whole milk to obtain the desired fat content of the kettle milk.

For the preparation of a Limburger cheese containing 15 per cent fat a kettle milk of 0.7 per cent fat content is required. For a 40 per cent fat content Limburger cheese a 2.4 per cent kettle milk is necessary, for an Emmental cheese

containing 40 per cent fat a kettle milk of at least 2.7 per cent fat, and for a 50 per cent fat content Camembert a kettle milk of from 3.5 to 3.6 fat content.

It is indicated that information of this nature is of value in view of the recent legislation in Germany in regard to the preparation and sale of cheeses of specified standards.

The milking machine a source of bacterial contamination of milk, G. F. RUEDIGER (*Jour. Infect. Diseases, 19 (1916), No. 4, pp. 652–654*).—Experimental data are submitted which indicate that milk may be badly contaminated by a milking machine if the teat cups and rubber tubes are not carefully cleaned and scalded before each milking. The use of chlorinated lime or like material does not satisfactorily prevent bacterial growth in the tubes.

It is further indicated that a mere inspection of the dairy without bacteriological control of the milk may fail absolutely to locate an insanitary process in the production of the milk.

Ice cream, L. M. DAVIS (*California Sta. Rpt. 1916, p. 48*).—The author reports that "there was no uniform relation between the consistency of an ice-cream mix and the percentage of swell where different thickeners were used. Increasing the consistency of the ice cream in the freezer by rapid freezing reduced the percentage of swell. Decreasing the amount of sugar in the ice-cream mix below normal increased the percentage of swell, but produced an unfavorable effect upon the finished product from the standpoint of flavor and texture. Increasing the amount of sugar in the ice-cream mix above normal decreased the percentage of swell, and, while it produced a better texture, resulted in ice cream which was too sweet. The consistency of an ice-cream mix can be increased by the use of thickeners to a point where the percentage of swell will be materially decreased."

VETERINARY MEDICINE.

Veterinary bacteriology, R. E. BUCHANAN and C. MURRAY (*Philadelphia and London: W. B. Saunders Co., 1916, 2. ed., pp. 590, figs. 209*).—This is the second edition of a volume by the senior author, previously noted (E. S. R., 26, p. 276). Many chapters have been completely rewritten and several new ones added. The organisms have also been regrouped in accordance with more recent conceptions of relationships.

Bacteriology.—General, pathological, and intestinal, A. I. KENDALL (*Philadelphia: Lea & Febiger, 1916, pp. X+17–651, pls. 9, figs. 98*).—This volume is divided into five general sections: General bacteriology; pathogenic bacteria; higher bacteria, molds, yeasts, filterable viruses, and diseases of unknown etiology; gastro-intestinal bacteriology; and applied bacteriology. Special emphasis is laid on the chemistry of the activity of the micro-organisms.

A text-book upon the pathogenic bacteria and protozoa, J. MCFARLAND (*Philadelphia and London: W. B. Saunders Co., 1916, 8. ed., rev., pp. 807, pls. 3, figs. 322*).—The eighth revised edition of the work previously noted (E. S. R., 28, p. 78).

The comparative resistance of bacteria and human tissues to certain germicidal substances, R. A. LAMBERT (*Jour. Amer. Med. Assoc., 67 (1916), No. 18, pp. 1300, 1301*).—A table giving results of a number of tests of the strengths of some common germicides necessary to kill bacteria and of the strengths necessary to kill tissue cells is submitted. Of the substances examined iodin was the only one by which the cells were not destroyed more easily than the bacteria. Mercuric chlorid, sodium hypochlorite (Dakin's solution), potassomercuric iodid, argyrol, and phenol did not exhibit any great difference, however.

The use of sugar as a dressing in veterinary surgery, G. Bussano (*Clin. Vet. [Milan], Rass. Pol. Sanit. e Ig., 38 (1915), Nos. 19, pp. 765–785; 20, pp. 810–816; 21, pp. 829–844+4, pls. 7; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 2, pp. 237–239*).—The literature on the use of sugar in surgery and its physiological properties is briefly reviewed, and experiments are described in which cane sugar or glucose was applied to sutured or other wounds, especially in operations on the feet. In some experiments solutions of glucose were injected intraperitoneally, subcutaneously, and into the joint cavities, trachea, and jugular vein. Horses and mules were used in the experiments described.

The results obtained indicate that glucose (5 to 10 per cent) injected subcutaneously, intraperitoneally, and into the joints is absorbed in a short time without any disturbance other than a slight rise in temperature. More concentrated solutions (25 per cent) at a temperature of from 29 to 30° C. may be injected into the trachea or jugular vein with the double advantage of being more rapidly absorbed and easily tolerated. Amounts of from 500 to 1,000 cc. may be injected daily without any functional disturbance, and by repeating the injection for several days a considerable improvement in the general condition of the animal is obtained. Powdered sugar applied to any wound acts as an absorbent antiseptic, and at the same time stimulates the nutrition of the tissues by the formation of a granular layer and rapid healing. When applied directly on sutured wounds it protects them from possible infection by initiating rapid healing. In foot operations accompanied by more or less considerable loss of tissue, and especially in the partial or total separation of the hoof, dressings of sugar rapidly cleanse the wound and promote a rapid growth of horny tissue. The deodorizing property of sugar also makes it valuable as a dressing. The formation of pus seldom occurs, even with moderately dilute solutions. When applied to a discharging or suppurating wound the discharge rapidly diminishes, and ceases with successive applications.

Although successful results were obtained with both cane sugar and glucose the author recommends the latter for various reasons. Because of its absorbent, antiseptic, and healing properties, and also its low price, sugar is deemed to constitute a dressing of the first order.

Colloidal chemistry and immunology, M. von Krogh (*Jour. Infect. Diseases, 19 (1916), No. 3, pp. 452–477, figs. 14*).—This is a theoretical discussion of the relations between colloidal chemistry and immunology, from which the general conclusion is drawn that colloidal chemistry is an important factor in immunology, but only one of several. "As an isolated method it does not explain anything at all, but as a help to disentangle the complicated processes concerned it may be of immense service."

An improved method for the concentration of antitoxic sera, Annie Homer (*Jour. Hyg. [Cambridge], 15 (1916), No. 3, pp. 388–400*).—The following technique is outlined:

To the serum or plasma diluted with one-third or one-fifth its volume of water sodium chlorid is added to a concentration of from 1.5 to 2 per cent. The material is heated to a temperature of from 56 to 57° C. for 15 hours, or to from 57 to 58° for 8 hours. The heated plasma is made 30 per cent of saturation with ammonium sulphate, and the mixture heated to and kept at a temperature of 61° for a few minutes. It is then cooled to from 40 to 45° and filtered, the precipitate is washed with 33 per cent of saturation with ammonium sulphate, the washings, after being filtered, are added to the main bulk of the filtrate which is then saturated 50 per cent with ammonium sulphate, and the resulting precipitate is filtered off, pressed, and dialyzed. The pressed precipitate has a yellowish color as distinct from the bluish-green color

of Banzhaf's product. To the residues from dialysis the necessary amounts of salt and preservative are added. The final product in bulk is of a reddish-brown color and does not exhibit even a trace of opalescence.

No difficulty has been encountered in the filtration of these products through pulp or Pasteur-Chamberland filters. The addition of two or three times its bulk of 1 per cent saline does not impair the ease of its filtration.

The method is claimed to be an improvement on the Gibson-Banzhaf method [1] because of a saving of time, labor, and material; the potency of the finished product is nearly twice as great; and the total loss of antitoxic units need not be greater than 10 per cent. The procedure is also claimed to be superior to the Banzhaf [2] one-fraction process for similar reasons.

The refinement and concentration of antitoxins, P. G. Heinemann (*Jour. Infect. Diseases, 19 (1916), No. 3, pp. 433–439*).—A modified procedure for the preparation of a refined antitoxic serum of higher concentration than could be obtained by any of the earlier methods proposed is described in detail. The serum produced was water-clear (for at least one year) and produced no trace of sediment. It readily passes through Berkefeld filters, and is easily discharged through a hypodermic needle. The antitoxic globulins obtained by the new method are easily soluble, and dialysis is consequently rapid. "Plasma of 100 and 200 units can be used to advantage, thus being offset the additional expense of production. Nonantitoxic proteins are eliminated in large measure and serum disease, as far as present observations go, is greatly reduced."

A concentrated hog-cholera serum was prepared by the new method, 7 cc. of which afforded ample protection to exposure, while from 20 to 30 cc. of the original material was required.

Another poisonous Claviceps, J. B. S. Norton (*Science, n. ser., 43 (1916), No. 1121, pp. 894, 895*).—The report of experiments by Brown and Ranck on the poisonous action of *Claviceps paspali* on Paspalum, previously noted (E. S. R., 34, p. 676), have led the author to record observations of a similar action of Claviceps found on *Paspalum læve* in Maryland. This fungus was first observed to be very abundant and conspicuous in the summer of 1902, in the autumn of which year a sample was received from a Maryland farmer who had taken it from a field where cattle had died with symptoms of poisoning. "The *Claviceps sclerotia* which replace the Paspalum grains are frequent in Maryland nearly every year, though in some years almost absent and sometimes, as in 1915, unusually abundant."

Report of the veterinary director general for the year ended March 31, 1914, F. Torrance (*Rpt. Vet. Dir. Gen. Canada, 1914, pp. 147, pls. 10*).—In addition to the main report of the veterinary director general (pp. 3–28), the reports of veterinary inspectors, etc., are given in 23 appendixes. Of these mention should be made of the following: Report of C. H. Higgins, pathologist at the biological laboratory at Ottawa (pp. 74–81); Epizootic Abortion Investigations.—Interim Report (pp. 82–88) and Strangles Vaccine (Experimental) (pp. 89–91), by T. C. Evans; Rabies and the Specificity of Negri Bodies (pp. 92–95), by A. B. Wickware; Avian Tuberculosis, by C. H. Higgins and A. B. Wickware (pp. 96–102), previously noted (E. S. R., 35, p. 576); Entero-hepatitis or Blackhead in Turkeys, by C. H. Higgins, A. B. Wickware, and N. M. Guiou (pp. 103–110); report of the pathologist at the veterinary research laboratory at Lethbridge, Alberta, E. A. Watson, on the serum test for dourine, etc. (pp. 111–116); An Outbreak of Dourine in the Unity District of Saskatchewan, by W. L. Hawke (pp. 117, 118); report of the pathologist at the veterinary research

[1] Collected Studies Research Lab. Dept. Health N. Y. City, 3 (1907), pp. 97–107.
[2] Loc. cit., 7 (1912–13), pp. 114–116.

laboratory at Agassiz, British Columbia, S. Hadwen (pp. 119–136), including A Study of Hematuria in France and Other Countries, etc., notes on Tick Paralysis Resulting from the Bites of *Dermacentor venustus* and on Warble Flies, etc.; and a Preliminary Note on the Effects of Feeding Rice Meal to Pigs, by P. H. Moore, Agassiz (pp. 137–140).

Annual report of the veterinary service for the year 1914, W. LITTLEWOOD (*Ann. Rpt. Vet. Serv., Egypt, 1914, pp. 49, pl. 1*).—This report deals with the occurrence and work of the year with contagious diseases of animals, the work of the veterinary pathological laboratory, etc.

The disinfection of tannery effluent containing anthrax spores, J. WINTERSBERGER (*Wiener Tierärztl. Monatsschr., 2 (1915), No. 8, pp. 353–379*).—Experimental data submitted show that only in isolated cases and under the most favorable conditions is a complete disinfection possible by the use of from 0.1 to 0.2 per cent chlorid of lime solution after contact from two to four days. By the use of 0.5 per cent chlorid of lime anthrax spores could be destroyed in the majority of the tests reported in three days. Such results, however, were not consistently reproducible or uniform. The disinfectant value increases with the concentration of the material used, a complete destruction of anthrax spores being obtained in three days by the use of 2 per cent chlorid of lime.

It is indicated that since the conditions in practice are not so favorable as experimental conditions the use of the disinfectants of stronger concentrations and for prolonged periods of contact is the safest procedure.

The addition of hydrochloric acid markedly increased the disinfectant strength of the chlorid of lime, and the procedure is deemed to be of practical value. The economical aspect in cases where a highly alkaline water is used would, however, have to be considered in the use of the acid.

Formaldehyde was found to be more active than chlorid of lime, but the cost when used in concentrations of from 0.5 to 1 per cent would be a disadvantage.

The data obtained in the use of various lime-vat mixtures confirm earlier investigations that by their use a partial destruction of spores is possible if the period of contact is prolonged. The spent mixtures were, however, often found to contain virulent spores.

The earlier observation that chlorid of lime exhibits a greater affinity for dead organic matter than for living material was confirmed.

The strength and composition of blackleg vaccines, O. M. FRANKLIN and T. P. HASLAM (*Jour. Infect. Diseases, 19 (1916), No. 3, pp. 408–415*).—This is a report of investigations made at the Kansas Experiment Station on the strength and composition of some of the most widely known blackleg vaccines.

The results show that the powder-form vaccines must be given in amounts of from 20 to 150 mg. to kill a guinea pig. Most of the commercial pellets were not fatal to guinea pigs in doses of three pellets per animal. Pellets which are too virulent produce severe vaccination losses.

"The pseudoblackleg bacillus differs from *Bacillus chauvœi* in its pathogenicity in rabbits, in the formation of a putrefactive odor, in the size and appearance of the colony in pure culture, in the gas formula, in the blackening of iron-sulphate agar, in the pathogenicity in guinea pigs highly immune to blackleg, and in the failure of blackleg immune serum to protect guinea pigs against a lethal dose of pseudoblackleg culture or a B pellet."

The ophthalmic test for glanders, with a simplified method of procedure, N. S. FERRY (*Jour. Amer. Vet. Med. Assoc., 50 (1916), No. 1, pp. 41–46*).—The tests commonly used for the diagnosis of glanders and the requirements of a most satisfactory diagnostic test are briefly reviewed.

The method proposed by the author consists of preparing a desiccated mallein by precipitating the crude mallein with several volumes of absolute alcohol,

washing the precipitate with ether, and drying in vacuo. The purified material thus obtained is incorporated with lactose into small tablets in such proportion that each tablet contains the exact amount of mallein for one test. The test is performed by placing the tablet directly into the conjunctival sac at the inner canthus of the eye, where it quickly dissolves without any apparent discomfort or annoyance to the animal.

The simplified procedure described is claimed to fulfill the requirements of a most satisfactory test, as indicated by earlier investigators.

An atypical case of rinderpest in a carabao, W. H. BOYNTON (*Philippine Bur. Agr. Bul. 31 (1914), pp. 5, fig. 1*).—Previously noted from another source (E. S. R., 31, p. 677).

The prophylaxis of tetanus by antitoxic serum, VAILLARD (*Presse Méd. [Paris], No. 49 (1916), pp. 393, 394*).—The author briefly discusses various experiences in which tetanus developed months after injury and treatment with antiserum. Nonmotile spores, but with apparently unlimited vitality, were found in leucocytes six months after injury. These facts demonstrate that the spores are not destroyed by the antiserum, but only by being incorporated and digested in the leucocytes.

A wound infected with tetanus spores may develop tetanus long after it is apparently healed. The danger is greatest where an infected foreign body remains in the muscle tissue. The results of experiments under such conditions have shown it to be absolutely impossible to prevent infections with antiserum injections, the only apparent result being a delay in the onset of the disease.

The application of the experimental facts observed to the disease occurring in wounded soldiers is indicated, and a few instances discussed.

In conclusion it is emphasized that the biological phenomena are too complex for any prophylactic measures to be absolutely infallible.

Researches in trichinosis, W. LINTZ (*Med. Rec. [N. Y.], 90 (1916), No. 23, pp. 987, 988*).—This paper reports experiments in which pieces of muscle tissue containing numerous living trichinæ were fed to albino rats.

"The rats as a rule became very sick 10 to 20 minutes after feeding; they would not move around, although they were very lively previous to feeding, their heads would droop, they refused nourishment, the breathing became very rapid, and they would begin to waste away. These symptoms lasted about four days, when the rats began to recover, and in two or three days appeared apparently normal."

Complement fixation in tuberculosis, H. J. CORPER (*Jour. Infect. Diseases, 19 (1916), No. 3, pp. 315–321, figs. 2*).—The studies reported show that virulent cultures of tubercle bacilli, free from all foreign substances and suspended in sterile salt solution, undergo autolysis at incubator temperature, the autolysis reaching a maximum from the sixth to the eighth day. "During the autolysis of virulent cultures of tubercle bacilli there is a coincident liberation of antigenic substances, which possess advantages over a suspension of living virulent tubercle bacilli as antigen for complement-fixation tests in tuberculosis."

The examination of 361 cases in which both an emulsion and an autolyzate prepared from living virulent human bacilli were used as antigen indicated that the complement-fixation test is not absolute, being positive only in about 30 per cent of all the clinically definite cases of the disease, both active and inactive. Active cases give a higher percentage of positive results than inactive cases. The value of the test for tuberculosis lies in the fact that in conjunction with other findings a definitely positive reaction makes the diagnosis certain. It is of value also from a differential diagnostic standpoint in that it indicates tuberculosis when positive as against other complications.

A positive test was never obtained in the absence of a positive von Pirquet reaction. A large percentage of clinically normal individuals giving positive von Pirquet reactions, however, yielded negative fixation tests.

It is deemed that "the practical absence of a reaction in nontuberculous cases makes this test, when positive, of far greater value in the diagnosis of tuberculosis than any of the biologic tests for tuberculosis thus far discovered."

Studies in immunization against tuberculosis, K. and S. Von Ruck (*New York: Paul B. Hoeber, 1916, pp. XVI+439*).—This volume is divided into three general parts: Theoretical considerations; practical immunization against tuberculosis; and experimental studies in the immunization against tuberculosis. Clinical and experimental data collected by the authors in their study covering a number of years are included.

Tuberculosis in Normandy, Fréger (*Bul. Soc. Cent. Méd. Vét., 92 (1916), No. 8, pp. 123-132*).—The prevalence and means of suppression of the disease are briefly discussed. The value of sanitary housing and stabling as prophylactic measures is strongly emphasized.

Sheep diseases, E. T. Baker (*Chicago: Amer. Jour. Vet. Med., 1916, pp. 237, pls. 6, figs. 66*).—Following discussions of the history of the breeds (pp. 15-52), the anatomy of the sheep (pp. 53-62), hygiene (pp. 63-74), and medicines and their administration (pp. 75-83), the more important diseases, poisonous plants, predatory enemies, etc., of sheep are briefly dealt with.

Shoeing and balancing the light harness horse, J. Clark (*Buffalo, N. Y.: The Horse World Co., 1916, pp. 101, pl. 1, figs. 50*).—A small handbook.

The epidemiology of pectoral influenza of the horse, K. Macek (*Wiener Tierärztl. Monatsschr., 2 (1915), No. 12, pp. 553-567; abs. in Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 6, pp. 848, 849*).—The author first refers to the work of Gaffky and Lührs, previously noted (E. S. R., 31, p. 382), and then reports studies made of 76 of 380 horses in a large stable that were affected with pectoral influenza (Brustseuche). His investigations led to the following conclusions:

"The incubation stage of pectoral influenza is much longer than has been generally supposed. In working horses it is from three to four weeks, while in resting horses twice this period may elapse before the outbreak of visible signs of the disease. This may account for outbreaks caused by bringing horses, quarantined for four weeks, into contact with healthy horses. Generally, during a four weeks' quarantine, the disease will make itself manifest. An infected horse can infect another horse not alone when distinct clinical symptoms of influenza are present, but also in the incubation stage, while it still appears to be in good health, and especially in the last few days preceding the outbreak of the disease.

"The spread of influenza may be checked with certainty if the first cases are recognized and promptly isolated, thus preventing contact between infected and noninfected horses. The isolation stall need not be far from the others and may even be among them so long as healthy animals are not exposed by contact. The direct transmission of influenza from horse to horse is the principal way in which it spreads. In this connection the stall, as well as various intermediate carriers (i. e., attendants, dirt, straw, feed, rats, mice, sparrows, blankets, harness, pails, etc.), play an unimportant rôle. Apparently the causative agent of influenza soon dies outside of the body of the horse.

"The spread of influenza from place to place is to be explained according to the previously made observations, i. e., that horses having a long incubation period transmitted the infection to other horses with which they had come in contact.

"Convalescent, symptomatically treated horses should not be permitted to come in contact with healthy ones until four weeks after the fever has subsided. However, animals in which the fever subsides in 36 to 48 hours after treatment with neosalvarsan may be released eight days after its drop to normal."

In most cases the author found a single infusion of 4.5 gm. of neosalvarsan to reduce the fever to normal within 24 to 36 hours.

A tri-radiate tapeworm (Anoplocephala perfoliata) from the horse, F. J. Meggitt (*Parasitology, 8 (1916), No. 4, pp. 379–389, pl. 1, figs. 2*).—A report of anatomical studies made of a tri-radiate form of tapeworm taken from a horse which had died from the cumulative effects of numerous parasites.

Diseases of the dog and their treatment, G. Müller and A. Glass (*Chicago: Alexander Eger, 1916, 4. ed., rev. and enl., pp. 506, pls. 17, figs. 178; rev. in Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 6, p. 881*).—A fourth revised and enlarged edition of the work previously noted (E. S. R., 21, p. 684).

Parasitological investigations (*Kansas Sta. Rpt. 1915, p. 20*).—Investigations have confirmed the report previously noted (E. S. R., 30, p. 485) that the fowl nematode (*Heterakis perspicillum*) may be transmitted by the dung earthworm (*Helodrilus parvis*), but indicate that the transmission is due to association rather than parasitism. It was found that cottontails and jack rabbits infested with tapeworm cysts may be fed to fowls without danger of transmitting the tapeworms.

RURAL ENGINEERING.

Annual report of the state engineer and surveyor of the State of New York, 1914 (*Ann. Rpt. State Engin. and Surveyor N. Y., 1914, pp. 448, pls. 64*).—This reports the activities and expenditures of the office of the New York State engineer and surveyor for the fiscal year ended September 30, 1914.

The action of copper sulphate on the algæ in drinking water, A. A. Bado (*La Acción del Sulfato de Cobre sobre las Algas de las Aguas Potables. Buenos Aires: Govt., 1916, pp. 15, pls. 4*).—Experiments on the treatment of La Plata River water with copper sulphate to destroy algæ are reported.

It was found that for that water the optimum amount of copper sulphate for algæ destruction is 2 parts per million, used at intervals of from five to ten days. It was further found that the coli bacteria were not entirely removed from the water by such treatment.

Chlorin treatment of water, R. Hilscher (*Cal. Bd. Health Mo. Bul., 12 (1916), No. 2, pp. 84–86, fig. 1; West. Engin., 7 (1916), No. 10, pp. 382, 383, fig. 1*).—A simple hypochlorite plant for treating water is illustrated and described, and the hypochlorite treatment is briefly compared with the liquid chlorin treatment.

Successful sewage disposal by broad irrigation, T. Bartlett (*Engin. News, 76 (1916), No. 13, pp. 586, 587, figs. 5*).—This article states that an average daily flow of sewage of about 13,500,000 gal. from San Antonio, Texas, is delivered to an irrigation company through the agency of which some 1,600 acres of private land are irrigated. A natural lake enlarged for the purpose is used to store the sewage when not needed for irrigation.

"The present annual quantity of sewage received from the city's trunk outlet is roughly estimated at 15,000 acre-feet. Of this some 8,000 acre-feet are applied to the lands by broad irrigation at an estimated average daily rate of 10,000 gal. per acre during the season. The remainder is impounded in the lake, together with from 400 to 800 acre-feet of storm water. From a small marshy flat the lake has been extended by successive increases in the height of

the dam, until it now covers some 900 acres to an average depth of from 8 to 10 ft. . . .

"The results of the disposal from the standpoint of avoidance of nuisance are extremely successful. . . . The broad, shallow lake, with partial dilution and abundant opportunity for sedimentation and oxidation, effects a high degree of purification, and there is no odor from it except a slight marshy smell."

Disposal of sewage from country houses, small institutions, and country clubs, P. HANSEN (*Ill. Health News, n. ser., 2 (1916), No. 8, pp. 151–167, figs. 11*).—This article deals with sanitary privies; chemical closets; sewage tanks, including Imhoff tanks; and purification systems, including tile absorption areas, intermittent sand filters, contact filters, and sprinkling filters.

Double tank proposed for residential sewage plants, W. S. COULTER (*Engin. Rec., 74 (1916), No. 10, pp. 298, 299, figs. 2*).—The author maintains that the logical arrangement for residential sewage-disposal plants is a septic tank and a short-period Imhoff tank placed in series. "The two-story tank then serves to intercept matter carried over from the septic tank and, if given reasonable attention, should insure a well-clarified effluent. The Imhoff tank should be provided with light, strong checkered plate covers to allow unobstructed access to the slopes and gas vent. . . . The upward-flow type possesses advantages peculiarly fitting it for the primary tank in such a series, the influent being admitted at a point near the bottom and caused to pass upward through the sludge accumulation."

The greenhouse type of sludge drying bed and a ventilating duct for aerating the tile fields are advocated.

Conveyance of water in open channels on the farm (*Jour. Electricity, 37 (1916), No. 14, pp. 261–263, figs. 4*).—Curves are given showing the carrying capacity of small earth ditches varying in area of water cross-section from 0.5 to 8 sq. ft. and in fall from 0.25 to 10 ft. per 1,000-ft. length, the capacity being expressed in miner's inches, second-feet, and gallons per minute.

Surface water supply of North Atlantic slope drainage basins, 1914, (*U. S. Geol. Survey, Water-Supply Paper 381 (1916), pp. 195+XXXVII, pls. 2*).—This report, prepared in cooperation with the States of Maine, Vermont, Massachusetts, and New York, presents the results of measurements of flow made on the St. John, St. Croix, Machias, Union, Penobscot, St. George, Kennebec, Androscoggin, Presumpscot, Saco, Merrimack, Connecticut, Housatonic, Hudson, Delaware, Susquehanna, Patuxent, Potomac, and Rappahannock river basins during 1914. Lists of the stream-gaging stations and the publications of the Geological Survey relating to water resources for this region are appended.

Supplement to the annual report of the state engineer and surveyor of the State of New York, 1914 (*Ann. Rpt. State Engin. and Surveyor N. Y., Sup., 1914, pp. 367*).—This report presents the results of measurements of flow made on streams in New York during 1914.

Oregon's opportunity in national preparedness, J. H. LEWIS, L. F. HARZA, G. STUBBLEFIELD, and E. J. MCCAUSTLAND (*Off. State Engin. Oreg. Bul. 5 (1916), pp. 120, figs. 28*).—This bulletin presents tentative plans and estimates of cost for the construction of a number of large water-power projects in Oregon, discusses possibilities for marketing some of this power, and points out direct and indirect benefits of such work, with special reference to the manufacture of nitrates, munitions of war, and fertilizers.

Rainfall and agricultural power use, S. B. SHAW (*Jour. Electricity, 37 (1916), No. 13, pp. 242, 243, figs. 4*).—The results of studies made in the Santa Clara Valley, Cal., on the effect of the amount of rainfall and of its distribution throughout the season upon the consumption of electric energy by irrigation plants are graphically reported.

It was found that "the amount of rain falling in a certain season influences the agricultural load in the succeeding months; thus when there is a season of heavy rainfall it is followed by a season of proportionally light irrigation and, therefore, of poor load factor on pumping plants, and vice versa. The time at which the rainfall occurs is also of importance. Thus, early fall rains during the months of September, October, and November will cause a rapid decrease in the pumping load at that time, while the late spring rains in March, April, and May will similarly delay the rise of the spring peak, both of which result in a decreased load factor and decreased total consumption. A concentration of the precipitation during the months of December, January, and February results in less penetration and replenishment of ground water and a greater run-off. This will result in an increase in the total annual consumption and load factor."

The normal average power consumption for the locality was found to be about 435 kilowatt hours per horsepower of plant capacity per annum.

Description of water wheel at Kudarangan Agricultural School, A. E. HALEY (*[Philippine] Bur. Pub. Works Quart. Bul., 5 (1916), No. 1, pp. 22, 23, fig. 1; abs. in Engin. News, 76 (1916), No. 9, pp. 409, 410, fig. 1*).—A water wheel for irrigation in the Philippine Islands is described and diagrammatically illustrated.

"Measurements of the wheel show that it raises about 25 gal. per minute, or 40,000 gal. per day, while operating in water flowing three miles per hour. Each bucket carries 4 gal. of water and the wheel makes a complete revolution in 70 seconds. The water raised is sufficient to irrigate about 1.5 hectares [3.7 acres] of ground."

A complete method for the classification of irrigable lands, F. H. PETERS (*Proc. Amer. Soc. Civ. Engin., 42 (1916), No. 7, pp. 1231–1251, pl. 1, figs. 7*).—This paper deals with the classification by the Dominion Government of an area of about 1,037,000 acres of irrigable land developed in the Province of Alberta. The climatic, soil, and crop conditions of the area are described and, as governed by these, the basis of the classification is stated as follows:

"Land shall be classified as irrigable (1) if it lies at a lower elevation than the point of delivery, after allowing a reasonable grade for a farm lateral. The point of delivery shall be deemed to be a point 3 in. below the crest of the measuring weir at or within the farm boundary. Where this measuring weir is not at or within the farm boundary, the point of delivery shall be the elevation of full supply level in the lateral supplying the field outlet and all measuring weirs shall be built in accordance with the plan of farm weirs filed with the commissioner of irrigation and dated November 1, 1908. The grade of farm laterals when a factor in land classification will be considered reasonable, (*a*) where the natural slope of the ground is less than 0.1 ft. in 100 ft. at a rate not less than 0.05 ft. in 100 ft.; (*b*) where the natural slope of the ground is greater than 0.1 ft. in 100 ft. at a rate of not less than 0.1 ft. in 100 ft.; and (*c*) where the slope of the ground is at or near the critical slope of 0.1 ft. in 100 ft. at either of the grades mentioned in clauses (*a*) and (*b*), such as good and reasonable practice demands. Extremely flat country may be irrigated by checks and flooding, and the grade of the farm lateral need not be considered in such cases, it being understood that the minister of the interior, or officers appointed by him, shall be the final judges of what constitutes 'extremely flat country.'

"(2) If such land can be reached by an estimated concentrated expenditure at one or more points for embankments, flumes, etc., not in excess of $8 per acre for the land to be served and benefited through them. (3) If such land

can be served by a second or other delivery at a cost not in excess of $8 per acre for the land to be served and benefited through them. (4) When lying in a depression, if it can be drained at a cost not exceeding $8 per acre and is suitable arable land which would be benefited by irrigation.

"(5) The prices to be made use of in estimating the cost of embankments, flumes, or other structures shall be, unless otherwise ordered by the Minister of the Interior [as follows]: Earth fill or excavation, 12 cts. per cubic yard; lumber in place on any structure, $40 per 1,000 ft. board measure; and rock riprap, 50 cts. per superficial yard.

"(6) In all unusual or exceptional cases, which are not covered by the preceding paragraphs, the classification will be made by officers of the department, under the direction of the minister of the interior, in a fair and reasonable manner, and will be based on the beneficial use of water."

Official proceedings of the sixth annual meeting of the National Drainage Congress at Cairo, Illinois (*Off. Proc. Nat. Drainage Cong., 6 (1916), pp. 96*).—These proceedings include the following special articles:

Federal Legislation, by F. H. Newell; The Relation of Drainage and Flood Control, by A. L. Webster; The Ohio Conservancy Act and State Legislation, by E. F. Bohm; Farm Drainage, by J. T. Stewart; Flood Prevention in the Miami Valley, by S. M. Woodward; Benefits from the Regulation of the Missouri River, by C. E. Jacoby; Reclamation and Flood Control in California, by V. S. McClatchy (see below); Food Protection in Indiana, by W. K. Hatt; Drainage Construction Problems, by W. A. O'Brien; Improving the Mississippi to Aid Commerce and Drainage, by T. H. Farmer; Relation of Land Drainage to Improvement of Rivers for Navigation, by J. L. Van Ornum; Organization Expenses and How to Meet Them, by R. B. Oliver, jr.; Work of the Illinois Rivers and Lakes Commission, by L. K. Sherman; The Drainage Situation in Oregon, by W. L. Powers.

Flood control and reclamation in California, V. S. McClatchy (*[Sacramento], Cal.: State, 1916, pp. 8, pl. 1; abs. in Off. Proc. Nat. Drainage Cong., 6 (1916), pp. 69, 70*).—This pamphlet briefly describes the different flood control problems in California, and includes a map showing the Sacramento River flood control project.

Reclamation of the Worden tract, D. Hansen (*U. S. Dept. Agr., Bur. Plant Indus., Work Huntley Expt. Farm, 1915, pp. 22–24, fig. 1*).—Drainage of a heavy alkali soil in which the water table stood at a depth of only 0.77 ft. lowered the ground-water table to a depth of 6 ft.

The experiment farm drainage system, F. B. Headley (*U. S. Dept. Agr., Bur. Plant Indus., Work Truckee-Carson Expt. Farm, 1915, pp. 12–14*).—Estimates of the total amounts of salts removed in the drainage water in the experimental drain on the project show that the largest amount of salt is removed during the irrigation season.

"A total of 214 tons of alkali has been removed by this drainage system in three years, approximately 8.5 tons for each acre of the area drained. The amount of salt in the upper 3 ft. of this portion of the farm amounts to approximately 9 tons per acre, or about the same amount as has been removed in three years by the drainage system. The soil of the area served by the drainage system does not show any appreciable reduction of its salt content in the upper 3 ft. It would appear, therefore, that the tile-drainage system draws alkali water either from sources deeper than the surface 3 ft. of soil or from an area much larger than the actual extent of the system. Beneficial results, as indicated by the improvement of crops, do not seem to have been obtained as yet from the installation of this system of drainage, although it

may have prevented a general rise of the ground water that would have been of serious consequence."

Some suggestions for the organization and financing of drainage projects, S. H. McCrory (*Agr. of Mass., 63 (1915), pp. 103–115*).—The author outlines briefly some of the fundamental principles governing the organization and financing of drainage districts. "Those who may be charged with the preparation of a law on drainage should make a careful, comprehensive study of the needs of the State, and of the laws of other States which have proved successful. Too much caution can not be exercised in drafting such a law so that it may be in harmony with the state and Federal constitutions and the trend of decisions on the subject."

Proceedings of the second Good Roads Institute, held at the University of North Carolina, February 23–27, 1915, compiled by J. H. Pratt and Miss H. M. Berry (*N. C. Geol. and Econ. Survey, Econ. Paper 43 (1916), pp. 122, figs. 7*).—These proceedings contain the following special articles: Considerations Governing the Proper Locations of Roads, by T. F. Hickerson; Economical Methods of Moving Rock, by W. S. Fallis; The effect of Grades Upon the Design and Location of Roads, by D. T. Brown; Economical Methods of Moving Earth in Road Construction, by N. C. Hughes, jr.; Sand-clay, Topsoil, and Gravel Roads, by C. M. Strahan; Sand-clay and Topsoil Roads in Craven and Wayne Counties, by R. E. Snowden; Sand-clay and Topsoil Roads in Orange County, by R. T. Brown; Use of Bituminous Compounds in Road Construction, by F. M. Whitfield; Specifications: A Discussion of Their Importance in Road Building, by B. S. Drane; and Road Maintenance, by W. W. Crosby.

[Road laws of the State of Kentucky] (*Ky. Dept. Pub. Roads Bul. 6 (1916), pp. 116*).—This is a compilation of the laws of Kentucky relating to public roads and their management.

Economic surveys of county highway improvement, J. E. Pennybacker and M. O. Eldridge (*U. S. Dept. Agr. Bul. 393 (1916), pp. 86, pls. 36*).—This is a compilation and analysis of data obtained in eight selected counties, Spotsylvania, Dinwiddie, Lee, and Wise counties in Virginia, Franklin County in New York, Dallas County in Alabama, Lauderdale County in Mississippi, and Manatee County in Florida, showing comparative financial burdens and economic benefits resulting from highway improvement during the period from 1910 to 1915, inclusive. On the whole the experience of the eight counties demonstrated that "the beneficial effects of the road improvement justified the outlay, and that while more efficiency and economy might have been obtained in some cases, the loss was not such as to make the citizens of any of the counties feel that the move for better roads had been an unwise one."

With reference to the increase in the values of farm lands it was found "that following the improvement of the main market roads the increase in the selling price of tillable farm lands served by the roads amounted to from one to three times the total cost of the improvements. The increases in values in those instances which were recorded ranged from 63 per cent to 80 per cent in Spotsylvania, from 68 to 194 in Dinwiddie, 70 to 80 in Lee, 25 to 100 in Wise, 9 to 114 in Franklin, 50 to 100 in Dallas, 25 to 50 in Lauderdale, and from 50 to 100 in Manatee." Considering the eight counties in the aggregate, the gross annual savings in hauling costs due to their good-roads systems amounted to a total of $627,409 for a traffic of 3,489,652 ton-miles. The average gross saving per ton-mile for the eight counties was 17.8 cts., this being indicated by an average rate of 33.5 cts. before the roads were improved, as compared with 15.7 cts. after the roads were improved. The net saving per ton-mile after deducting the cost of the interest and principal was 11.6 cts.

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A comparison of the effect of the road improvement upon country schools showed that before the roads were improved the average school attendance was 66 pupils of each 100 enrolled, as compared with 76 after the roads were improved, showing that the good roads have been materially responsible for the education of 10 children out of each hundred.

Bituminous macadam and bituminous concrete pavements, A. H. Blanchard (*Municipal Jour., 41 (1916), No. 14, pp. 405–411, figs. 9*).—This article summarizes the more recent opinions of authorities on the materials and methods requisite for the most successful construction and maintenance.

In monolithic pavements in Vermilion County, Illinois, brick are laid directly on concrete base, H. H. Edwards (*Engin. Rec., 74 (1916), No. 14, pp. 400–402, figs. 7*).—This article summarizes experience in which the thin layer of dry sand and cement was discarded. The brick were grouted immediately after rolling.

Distribution of traffic on a rectangular system of roads analyzed, E. W. James (*Engin. Rec., 74 (1916), No. 15, pp. 439–441, figs. 2*).—Tabular data are reported which show the relative travel on various types of roads where the development is uniform throughout a township and where it is unequal and more in accordance with ordinary experience. It is pointed out that from 80 to 85 per cent of all traffic in any large area is carried by 15 or 20 per cent of the roads and that expenditures should be governed accordingly.

Progress reports of experiments in dust prevention and road preservation, 1915 (*U. S. Dept. Agr. Bul. 407 (1916), pp. 71*).—New experiments begun by the Office of Public Roads and Rural Engineering during the year 1915 are described. These included experiments on bituminous macadam (penetration and mixing methods) and bituminous gravel concrete on Mount Vernon Avenue road, Alexandria County, Va.; bituminous surface treatment on Falls Road, Montgomery County, Md.; penetration macadam on Bradley Lane, Montgomery County, Md.; bituminous concrete at Washington, D. C.; oil-asphalt-coralline rock at Buena Vista, Fla.; oil-asphalt-sand at Jupiter, Palm Beach County, Fla.; bituminous-sand, mixing methods at West Palm Beach, Fla.; and sand-asphalt at Ocala, Fla.

Supplementary reports on experiments previously reported (E. S. R., 33, p. 686) are included on oils, tar preparation, calcium chlorid-coralline rock at Lemon City, Fla.; oil, tar, oil-asphalt-coralline rock at West Palm Beach, Fla.; oil-coralline rock at Miami, Fla.; bituminous surface treatment on Rockville Pike, Montgomery County, Md.; tar preparation and oil-surface treatment at Washington, D. C.; bituminous concrete, cement concrete, oil-cement concrete, vitrified brick, bituminous surface treatment on concrete and bituminous construction and surface treatment at Chevy Chase, Md.; oil-cement concrete, oil asphalt, tar and fluxed native asphalt at Jamaica, N. Y.; oil-asphalt-gravel at Ames, Iowa; tar and oil preparations at Knoxville, Tenn., 1910; slag, lime, waste sulphite liquor and tar at Youngstown, Ohio; sand-clay at Dodge City, Garden City, Bucklin, and Ford, Kans.; and Kentucky rock asphalt at Bowling Green, Ky.

Road dust preventives: References to books and magazine articles (*Pittsburgh, Pa.: Carnegie Library, 1916, pp. 39*).—A list of 361 references to books and magazine articles bearing on the subject is given.

Concrete construction for rural communities, R. A. Seaton (*New York and London: McGraw-Hill Book Co., 1916, pp. XI+223, pl. 1, figs. 96*).—This is a semitechnical treatise on the essential features of concrete construction on farms and in rural communities. It is divided into five parts. Part 1, Materials, deals with cements and limes, cement specifications and tests, and aggre-

gates; part 2, Plain Concrete, deals with proportions and quantities of materials, construction of forms, and mixing and handling concrete; part 3, Reinforced Concrete, deals with general principles and strength of reinforced concrete; part 4, Miscellaneous Matters, deals with concrete surface finishes, stucco and plaster work, waterproofing and coloring concrete, and casting in molds; and part 5, Typical Applications of Concrete, deals with sidewalks, floors, and roads; tanks, cisterns, and silos; and small highway bridges and culverts.

Official tests of mechanical cultivation (*Jour. Agr. Prat., n. ser., 29 (1916), No. 13, pp. 230–232, figs. 2*).—Tests on the cultivation of very light sandy soil with a 16-horsepower and a 25-horsepower tractor are reported. The former weighed 2,800 kg. (about 3 tons) and had a horizontal single-cylinder motor running at about 400 revolutions per minute. The latter weighed 4,700 kg. and had a horizontal two-cylinder opposed motor running at about 550 revolutions per minute. The test results are given in the following table:

Mechanical cultivation tests.

Type of cultivator.	Tractor, horsepower.	Depth of cultivation.	Width of cultivation.	Average speed per hour.	Area cultivated per hour.	Fuel consumption. Per hour.	Fuel consumption. Per hectare.
		Centimeters.	*Meters.*	*Meters.*	*Square meters.*	*Kilograms.*	*Kilograms.*
3-bottom plow	16	16.0	0.97	3,276	2,325	5.66	24.3
4-bottom plow	25	20.9	1.26	2,736	2,460	6.72	27.3
12-tooth cultivator, soil plowed one week	16	6.5	2.00	3,348	4,762	4.43	9.3
12-tooth cultivator, soil recently plowed	16	11.0	2.00	3,348	4,762	4.84	10.1
12-tooth cultivator on fallow	16	7.0	2.00	3,348	4,762	4.02	8.2
14-disk harrow on fallow	16	4.0	2.10	3,348	5,000	4.06	8.1
14-disk harrow, soil recently plowed	16	10.0	2.10	3,276	4,958	5.22	10.5

Official tests of mechanical cultivation (*Jour. Agr. Prat., n. ser., 29 (1916), No. 15, pp. 262–264, figs. 2*).—Tests of a 3-wheeled tractor with a 4-cylinder vertical motor rated at 20 horsepower in plowing, rolling, and harrowing on a heavy clay soil are reported. The two front wheels, 0.62 meter (24.4 in.) in diameter, are guide wheels and the rear wheel, 1.52 meters in diameter, is a driver. The total weight of the tractor is 2,800 kg. (about 3 tons). The test results are given in the following table:

Mechanical cultivation tests.

Cultivating apparatus.	Depth of cultivation.	Width of cultivation.	Area cultivated per hour.	Fuel consumption. Per hour.	Fuel consumption. Per hectare.	Average speed per hour.
	Centimeters.	*Meters.*	*Square meters.*	*Kilograms.*	*Kilograms.*	*Meters.*
2-bottom plow	15.7	0.61	2,083	8.60	41.2	5,292
Do	22.7	.58	1,087	5.40	49.6	2,592
4-bottom plow	17.5	1.00	1,887	5.50	29.1	2,772
3-bottom plow	15.0	.94	2,421	6.90	28.5	3,600
Do	20.4	.94	2,364	7.26	30.7	3,492
Do	13.0	.94	1,886	7.86	40.9	2,772
Do	18.0	.88	1,744	8.51	49.0	2,700
13-tooth cultivator	10.0	1.56	3,333	6.32	18.9	2,988
13-tooth cultivator and roller	10.0	1.56	3,225	7.59	23.5	2,880
48-tooth harrow on plowed soil	4.5	2.00	6,900	8.22	11.9	5,400
13-tooth cultivator on fallow soil	10.0	1.56	3,186	6.27	19.8	2,808

Dairy barn construction, L. A. HIGGINS and D. SCOATES (*Miss. Agr. Col. Ext. Dept. Bul. 2, pp. 8, figs. 7*).—This bulletin points out the essential features in dairy-barn construction, and gives diagrammatic illustrations of the more important details in construction.

Building instructions for homemade silos, G. L. OLIVER (*West Virginia Sta. Bul. 157 (1916), pp. 14–23, figs. 8*).—This is a revision of Circular 8, on the construction of wooden hoop silos (E. S. R., 32, p. 888), with additional information, prepared in cooperation with the U. S. Department of Agriculture, on the building of stave and plastered silos.

Poultry houses, E. J. PETERSON (*North Dakota Sta. Circ. 14 (1916), pp. 4, figs. 4*).—The general requirements of poultry house construction to meet North Dakota conditions are outlined.

A farmer's poultry house, J. G. HALPIN and L. M. SCHINDLER (*Wis. Col. Agr. Ext. Serv. Circ. 62 (1916), pp. 4, figs. 2*).—Plans and a bill of materials for a poultry house to accommodate 125 hens are given.

A dual-purpose poultry house, J. HADLINGTON (*Agr. Gaz. N. S. Wales, 27 (1916), No. 9, pp. 656–659, pl. 1, figs. 2*).—Plans and brief specifications for a poultry house to serve as a brooder and laying house are given.

RURAL ECONOMICS.

Successful farm organizations, O. R. JOHNSON (*Missouri Sta. Bul. 142 (1916), No. 9, pp. 656–659, pl. 1, figs. 2*).—Plans and brief specifications for a already noted in Bulletins 121 and 140 (E. S. R., 32, p. 791; 35, p. 692).

The author, in summarizing the results of this survey, indicates that about 40 per cent of the farmers in the regions studied made less than $200 labor income, and about 70 per cent made less than $600. The average labor income was about $1.35 per day. The most successful farmers had farms larger than 200 acres.

The least successful farmers had 7 per cent more of their capital invested in real estate than did the most successful farmers. This difference in capital was chiefly invested in live stock in case of the better class of farmers. On the more successful farms the workmen handled from 60 to 100 per cent more crop acres than did the workmen on the less successful farms. The better farmers kept more live stock and a larger proportion of this stock was in productive stock and less in work stock. The less efficient farmers received from $17 to $25 per animal unit while the better farmers received from $37 to $47.

Sixty-eight per cent of the best farms had more than three important sources of income. The crop yield index on the best farms was 124.8 and on the poorest farms 86.8. The farmers realizing the better incomes used one-fifth less feed for each animal unit kept, but realized four times as much in return for each $100 worth of feed used.

Farming on the cut-over lands of Michigan, Wisconsin, and Minnesota, J. C. McDOWELL and W. B. WALKER (*U. S. Dept. Agr. Bul. 425 (1916), pp. 24, figs. 10*).—Among the conclusions set forth by the authors from their study of conditions on 801 typical farms in this area and an investigation of farm enterprises on 80 farms, were the following:

With average yield and average price, potatoes furnish a satisfactory cash crop in practically all parts of the district. Large acreage, however, is not to be generally recommended on account of the danger of low prices resulting from local overproduction. Other valuable cash crops adapted to certain areas are hay, clover seed, peas, beans, hairy vetch, seed corn, oats, rye, wheat, barley, small fruit, and garden vegetables.

As there are few large cities, the demand for truck crops is somewhat limited in most parts of the district. The well-managed farms produce an abundance of home supplies, such as vegetables, small fruit, milk, butter, eggs, and meat.

Dairying combined with cash crops is financially profitable when production per cow is high and crop yields above the average. The production of sheep or beef cattle as a major enterprise, while not common in the district, is furnishing satisfactory incomes on a few farms. Hog production may be profitably combined with dairying where corn matures and on farms where rye, barley, soy beans, or Canadian field peas can be substituted for corn.

On account of the opportunity to use extra labor to advantage at all seasons of the year, either in lumbering or in clearing land, seasonal distribution of farm labor has not yet become an important problem in recently settled sections. A large amount of family labor is available, much of which is not used to advantage. The crop area per horse is too small for the most profitable use of labor. Small irregular fields and numerous stumps prevent the most efficient use of farm machinery. Few farmers in this district are rapidly accumulating wealth, but, with ceremony and good management, there is an opportunity to make a living and a little more.

Management of muck-land farms in northern Indiana and southern Michigan, H. R. SMALLEY (*U. S. Dept. Agr., Farmers' Bul. 761* (*1916*), *pp. 26, figs. 12*).—Four distinct types of farms were found among the muck lands, namely, celery, onion, peppermint, and grain and stock farms.

Among the conclusions drawn by the author were that the use of fertilizer, especially potash, on muck soils is very profitable, the yields being increased in most cases from 50 to 200 per cent.

Celery and onions require an enormous amount of man labor as compared with corn, oats, and hay. Peppermint, cabbage, and potatoes occupy an intermediate position. The gross acre value of the intensive crops is high, but the value of these crops per day of man labor is not so high as in the case of the extensive crops. The average labor income for 28 celery farms was $394; for 23 onion farms, $1,732; for 10 peppermint farms, $1,519; for 39 grain and stock farms, $1,056; and for 7 of the more successful grain and stock farms, $1,994. The grain and stock farms provide a much better distribution of labor throughout the year than the other types and are deemed a much safer type of farming, although the profits per acre may be less.

Cost accounts on some New York farms, C. E. LADD (*New York Cornell Sta. Bul. 377* (*1916*), *pp. 771–815, figs. 3*).—This bulletin gives the results obtained from keeping a complete set of cost accounts on 13 New York farms for 1912 and 31 for 1913. It contains a large number of statistical tables, showing the hours of labor for man and horse and the cost per hour and per acre. It also gives the cost per acre and per horse for equipment, the extent, value, cost, and profit of various farm crops, live stock, and the monthly distribution of labor by enterprises and operations in connection with the individual enterprises.

Cotton ginning information for farmers, F. TAYLOR, D. C. GRIFFITH, and C. E. ATKINSON (*U. S. Dept. Agr., Farmers' Bul. 764* (*1916*), *pp. 24, figs. 25*).—The authors conclude that the present mechanical construction of gins makes it almost impossible for them to maintain the purity of each grower's seed on account of the added expense to the ginner in bringing about such conditions as will insure the accurate separation of seed which is to be used for planting purposes from the seed of other varieties of cotton. They consider it desirable that gin manufacturers develop some device which will insure a quick and ac-

curate method of keeping separate the seed ginned from each wagon load of seed cotton. They also discuss the methods of keeping accounts and the arrangement and use of ginning machines to bring about a better marketing condition for the cotton. Attention is called to the careless preparation of the American bale of cotton and the seeming indifference on the part of the farmer, the buyer, and others handling the American bale which causes the farmer a considerable loss. "By concerted action the farmers should be able to secure better methods of ginning, maintain pure planting seed, and secure uniform and better handling of their cotton. This would enable them to market their crops to a better advantage."

Community organization for promoting the production of swine, C. G. Starr (*Indiana Sta. Circ. 54* (*1916*), *pp. 12, figs. 2*).—In addition to a brief discussion on the improving of swine production by better feeding, breeding, and management, the author discusses the control of hog cholera by community effort and points out how hog cholera is spread and how the community can be organized to control this disease. There is included a proposed plan of community organization and a model constitution and by-laws.

[Studies in agricultural economics] A. E. Cance (*Massachusetts Sta. Rpt. 1915, pt. 1, pp. 69a, 70a*).—There are two main types of agricultural insurance practiced in the New England States—live stock insurance, which is confined mainly to insurance on race-horse stock and exhibit stock when shipped to shows, and hail insurance of tobacco against damage by hail. Brief notes are given regarding these.

A study of the methods and cost of growing and distributing onions in the Connecticut Valley indicates that the cost of production and marketing is from 36.6 to 40.6 cents per bushel.

A survey of typical cooperative stores in the United States, J. A. Bexell, H. Macpherson, and W. H. Kerr (*U. S. Dept. Agr. Bul. 394* (*1916*), *pp. 32, pls. 2*).—Data collected from 60 stores in 10 states by the Office of Markets and Rural Organization in cooperation with the Oregon Agricultural College are reported and discussed.

"The figures collected in this survey bring out the conclusion that the majority of the cooperative stores established are unsuccessful in achieving their main object—saving on purchases to members and a reduction of the high cost of living. This conclusion is borne out by the supplementary notes collected from managers who could not apply statistics, and by notes on interviews with leaders who are acquainted with the store movement in whole sections which could not be covered in detail. But that there is one real service which the cooperative stores have performed seems to have been demonstrated again and again. Even in cases where stores have failed absolutely and gone into bankruptcy they have frequently been responsible for the introduction of improved business methods in the towns where they were established. They have had the effect of stimulating competition. In cases where the merchants have competed keenly against the cooperative store they have been compelled to adopt more efficient business methods. This has resulted in lower prices to every consumer in the locality and frequently in better prices to farmers on produce."

The authors believe that the conditions necessary for success are good leadership, capable management, favorable environment, and adequate legal safeguards, and that a lack of these generally is the cause of failure. Throughout the bulletin are included a number of statistical tables setting forth the various facts concerning the stores from which this survey was made.

Rural clubs in Wisconsin, C. J. Galpin and D. W. Sawtelle (*Wisconsin Sta. Bul. 271* (*1916*), *pp. 58, figs. 22*).—The authors believe that living on good terms with folks is a part of modern farming, as truly as knowing how to farm,

and that the higher level of efficiency is reached in the science and art of local agriculture when families know one another well and meet frequently. A strong circulation of ideas and impulses is deemed necessary to counteract discontent and the temptation to sell out and move away from rural districts.

The authors state that about one-fifth of the farmers in Wisconsin are members of or attend the meetings of various rural clubs. They have divided the rural clubs into four typical groups and describe typical instances to illustrate the types. The four types mentioned are the farmers' family club, the farm men's club, the farm women's club, and the young folks' club.

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt., 2 (1916), No. 10, pp. 97–108, figs. 3*).—Among the data included in this report are the usual data relative to the condition of the principal crops, their estimated farm values, and the range of prices of agricultural products at important markets. Special reports are included concerning the commercial production of cabbage, cucumbers, the monthly disposition of cotton by producers, the quantity of commercial fertilizer applied per acre of cotton, the trend of prices paid producers, wheat statistics for the world and the United States, and the estimated production of apples by States from 1890 to 1915. A special map is also included showing the location of the township crop reporters.

AGRICULTURAL EDUCATION.

Agricultural education, H. J. Waters (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 193–199*).—The author discusses the principal purpose of agricultural education, the tax of wastes upon the cost of living, high acre yields and low man yields, what city people and country children should be taught, and where agriculture should be taught.

In his opinion city children should not be required to study the details of plant and animal production, but should be so taught that they will have an interest in, and a general understanding of, these basic industries, so that they will realize that they are dependent upon those who till the soil, not only for their food and clothing, but also for the materials which form the basis of most of the city's industries. On the other hand, country children should be taught how to produce high-acre yields without bringing upon themselves the evils of the intensive methods of other countries and of other times.

The failure of early attempts to teach agriculture is attributed principally to the fact that the farmer himself knew more about farm practice than did the teacher. This led to the establishment of agricultural experiment stations, a deliberate attempt, for the first time in he history of education, to create, through a well coordinated system of scientific research, a body of knowledge in relation to a subject which it was deemed important to teach but about which so little of a definite nature was known that it could not be taught successfully. Attention is also called to another important departure from educational traditions, viz, an organized system of extension or continuation teaching through which parents as well as pupils are reached with new-found knowledge.

The author concludes that "income and idealism are the principal elements out of which a stable and satisfactory rural civilization will be built. To build such a civilization is the only possible excuse we can offer for devising and maintaining a system of agricultural education."

Progress of elementary agricultural education in Nova Scotia, L. A. DeWolfe (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 520–522*).—According to this article school gardening and nature study are making about the

same progress in Nova Scotia as in this country. The school garden has not proved a success because of the vacation problem, but children's gardens on the home grounds have proved popular and school exhibitions are a prominent feature of the work each autumn. More stress is laid on flower culture than on vegetable culture, as the same cultural principles belong to both and the flowers are more interesting.

The teachers, who are the leaders in this work, take a special training course for two or three summers at Truro, these courses being conducted jointly by the normal and agricultural colleges and leading to a rural science diploma. Teachers receive a small additional salary grant, $25 or $50, for rural science work.

The efficient country school, D. B. JOHNSON (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 683–687*).—The author discusses the vital need in this country of the efficient country school, with its equipment, curriculum, and teacher.

Applied science as the basis of the girl's education, HAZEL W. SEVERY (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 1020, 1021*).—In this article science courses to meet the general needs of all girls are classified under two heads: (1) Courses for girls who are planning a scientific or technical education, and (2) courses which make better homes because the sciences are taught in a simple but practical way. The latter are discussed, including a consideration of what they should consist and a few of their possibilities.

Special science for girls in the rural schools, BLANCHE O. TWISS (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 1015–1019*).—The author emphasizes the need of the teaching of sciences for both boys and girls, and of well-grounded, finely trained women of broad experience to conduct this work in rural communities. In her opinion the science work for girls in the rural schools should be chosen from the fields of chemistry, botany, physiology, and biology, including bacteriology, to be taught in close correlation with cooking and sewing. Correlation and problem exercises or projects are recommended, and some correlations are suggested.

Home economics applied to life, MARTHA VAN RENSSELAER (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 821–824*).—The author discusses home economics as the medium of carrying into the home the principles of both science and art to establish high standards of living and right community and home ideals.

Project teaching, J. A. RANDALL (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 1009–1012*).—The chief object of this paper is to propose a technical definition for the word "project," and to expand the idea for which the term seems to stand. Illustrations of individual and community projects are given and their relative advantages discussed.

Judging the dairy cow as a subject of instruction in secondary schools, H. P. BARROWS and H. P. DAVIS (*U. S. Dept. Agr. Bul. 434 (1916), pp. 20, figs. 15*).—This bulletin gives specific directions, including classroom discussion and field practice, for the scoring and judging of the dairy cow as a practicum in the teaching of agriculture in secondary schools.

Proceedings of the twentieth annual meeting of the American Association of Farmers' Institute Workers, edited by L. R. TAFT (*Proc. Amer. Assoc. Farmers' Inst. Workers, 20 (1915), pp. 155, figs. 3*).—A detailed report of the proceedings of the meeting held at the University of California, Berkeley, August 12 to 14, 1915. It includes a report of the Farmers' Institute Work in the United States in 1914–15, by J. M. Stedman, and the following papers: Address of Welcome, by T. F. Hunt; Response, by T. B. Parker; President's

Annual Address, by T. B. Parker; The Farmer and Peace, by D. S. Jordan; How Can Smith-Lever Funds be Used for the Furtherance of Farmers' Institutes? by W. T. Clarke; The Ideal Institute Lecturer, E. C. Johnson; Movable Schools of Agriculture and Their Work, by G. I. Christie; The Cooperation of Farmers' Institutes With Other Educational Agencies, by F. S. Cooley; Demonstration Work in Farmers' Institutes, by J. M. Stedman; The Farmers' Responsibilities, by H. J. Waters; How Can We Help the Boys? by B. Knapp; Women's Institutes of the Province of Ontario, by G. A. Putnam; Extension Service for Women, by E. G. Peterson; Extension Work for Rural Women, by Mamie Bunch; Extension Work for Rural Communities, by Mary E. Sweeney; Home Demonstration and Its Possibilities, by Gertrude McChene; Equipment for Extension Work in Home Economics, by Ava B. Milam; Rural Work in Home Economics in Missouri, by May C. Macdonald; How Far Should Entertainment be Made a Feature of Farmers' Institute Work? by A. J. Cook; The Market Problem and How Can Farmers' Institutes Help to Solve It, by C. J. Brand; Tillage, Its Rationale and Its Dangers, by C. B. Lipman; Shall Extension Services Include the Social, Recreational, and Educational Improvement of Rural and Urban Districts? by W. D. Hurd; Organization and Methods in Home Economics, by Mrs. H. W. Calvin; and Home Demonstrations, by Mary E. Creswell. Statistics of farmers' institutes in the United States and in Canada for 1914–15 are included.

MISCELLANEOUS.

Annual Report of California Station, 1916 (*California Sta. Rpt. 1916, pp. 133, pl. 1, figs. 5*).—This contains the organization list and a report of the director on the work and publications during the year, including a list of the station projects and some data pertaining to the instruction and extension work of the college of agriculture. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Report of Kansas Station, 1915 (*Kansas Sta. Rpt. 1915, pp. 69, figs. 21*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1915, a report of the director summarizing the work and publications of the station, and two special articles. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Twenty-eighth Annual Report of Massachusetts Station, 1915 (*Massachusetts Sta. Rpt. 1915, pts. 1–2, pp. VIII+72a+194, pls. 8, figs. 11*).—This contains the organization list, reports of the director and heads of departments, a financial statement for the fiscal year ended June 30, 1915, and reprints of Bulletins 163–167, previously noted. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirty-fifth Annual Report of Ohio Station, 1916 (*Ohio Sta. Bul. 300 (1916), pp. XXIV, figs. 2*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1916, and a report of the director summarizing the work and publications of the station during the year.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta., Mo. Bul., 4 (1916), No. 7, pp. 16, fig. 1*).—This number contains brief articles on the following subjects: Home Canning, by T. J. Newbill; The Value of Cow-testing Associations, by O. E. Gibson; Dairy Farming Problems, by H. L. Blanchard; Hints on Storing and Marketing Potatoes, by J. L. Stahl; Fall Plowing, by E. B. Stookey; Getting Fall and Winter Eggs, by Mr. and Mrs. G. R. Shoup; and Concerning Mold on Berries, by A. Frank.

NOTES.

Alabama College and Station.—G. C. Starcher, associate professor of horticulture and associate horticulturist at the Virginia College and Station, has been appointed professor of horticulture and horticulturist, vice Ernest Walker, resigned to engage in commercial work.

Georgia Station.—F. H. Smith, assistant chemist, has been appointed head of the department of chemistry beginning January 10. His work will be confined largely to animal nutrition along the lines already under way.

Kansas College and Station.—Among the changes effective January 1 was the resignation of Dr. James W. Benner, instructor in veterinary medicine, to become assistant professor in the veterinary department in the Michigan College. Dr. Benner has been succeeded by Dr. J. P. Scott, who was appointed a fellow in pathology in the college last fall. Kurt Peiser, assistant in dairy bacteriology, has resigned to become milk inspector for the Board of Health at Cleveland, Ohio, and has been succeeded by J. R. McClung, assistant in chemistry in the college. Dr. Thomas P. Haslam, pathologist in the station, has resigned to engage in commercial work.

Michigan College.—Dr. J. P. Hutton has resigned as assistant professor of veterinary surgery to engage in commercial work.

Minnesota University.—About 1,500 farmers and farmers' wives attended the annual week's short courses in the college of agriculture.

Nevada University.—Mrs. Edna C. Baker of Sparks, B. F. Curler of Elko, and F. Abel of Reno were elected to the board of regents, vice Messrs. Dodd, Henderson, and Pratt, effective January 1. The resignation of President A. W. Hendrick took place January 4, on demand of the board, and Robert Lewers was appointed acting president. Paul Gaston, comptroller, also resigned and was succeeded by C. H. Gorman, a former comptroller.

New Jersey Stations.—At a recent meeting of the board of managers of the State Station, James Neilson was elected president of the board, George E. DeCamp, vice-president, and Irving E. Quackenboss, secretary-treasurer. J. P. Helyar was appointed State seed analyst, also continuing at the head of the station seed laboratory.

Louis J. Kleinfeld, assistant chemist in the State Station, resigned December 1, 1916.

The three-year international egg-laying and breeding contest, begun November 1, 1916, at Vineland, is now in full operation. The entries number 100 pens of 10 birds each, representing all of the more important breeds.

Ohio Station.—C. B. Williams, agronomist, has been appointed associate director. G. K. Livaslian has been appointed assistant in the soil survey, vice A. H. Huisken resigned.

Oregon College.—At the invitation of President Kerr the entire legislative assembly visited the college January 20, this being its first official visit in six years.

Carl L. Kennedy, assistant professor of animal husbandry, has resigned to become county agent of Polk County, Iowa.

Pennsylvania College and Station.—L. F. Reese, instructor in horticulture, resigned January 1. L. D. Jesseman has been appointed instructor in horticulture, effective January 15, and Albert White, assistant in vegetable culture at the Maryland College, has been appointed superintendent of greenhouses and instructor in horticulture, effective on the same date.

South Carolina College and Station.—J. N. Harper has resigned as dean of the agricultural department, director of the station, and agronomist to engage in commercial work.

Tennessee University.—J. C. Pridmore, associate professor of agronomy, resigned February 1 to engage in commercial work, and has been succeeded by R. B. Lowry.

Utah College.—W. W. Henderson has been appointed professor of zoology and entomology, vice E. G. Titus whose resignation has been previously noted.

Virginia Station.—K. E. Quantz, special assistant in horticulture, and R. H. Cook, superintendent of the Charlotte County substation, resigned December 31, 1916, to accept positions with the Government of Brazil. Mr. Cook has been succeeded by A. P. Moore, a 1916 graduate of the college. Dr. M. T. Smulyan, assistant entomologist for the State Crop Pest Commission, whose experimental work is affiliated with the station, also resigned December 31 to accept a position with the Bureau of Entomology of the U. S. Department of Agriculture.

American Society of Agronomy.—The ninth annual meeting of the American Society of Agronomy was held in Washington, D. C., November 13 and 14, with the largest attendance on record.

The presidential address was given by C. R. Ball at a joint session held with the Society for the Promotion of Agricultural Science and the American Farm Management Association. Mr. Ball took for his subject Some Problems in Agronomy, and suggested a long list of problems along agronomic lines that are yet unsolved. Among other things, he discussed the preparation of investigators, and emphasized the necessity of a broad fundamental training in the sciences and languages before the student began to specialize. Cooperation among institutions in experimental work was suggested, as well as the conducting of group studies. In conclusion he spoke of the evolution of procedure, the increasing refinements of methods, and the necessity of definitely outlining proposed work and keeping adequate records.

Other papers presented before the society included the following: The Carbon Dioxid Content of a Planted and Unplanted Limed and Unlimed Soil, by T. L. Lyon and J. A. Bizzell; The Possible Rôle of the Active Organic Matter of the Soil, by C. J. T. Doryland; Field Crops and Bacterial Transformation of Soil Nitrogen, by K. F. Kellerman and R. C. Wright; A Method of Determining the Volume Weight of Soils in the Field, by C. F. Shaw; Studies on the Relation of the Cob to Other Ear Characters in Corn, by A. E. Grantham; Composts as an Aid in Soil Building, by J. G. Lipman; The Relation of Live Stock to the Maintenance of Organic Matter in the Soil, by E. O. Fippin; What is Agronomy, by A. N. Hume; The Sugar Beet as a Factor in National Preparedness, by C. O. Townsend; The Soil Mulch, by L. E. Call and M. C. Sewell; The Effect of Inoculation on Yield and Protein Content of Alfalfa and Sweet Clover, by A. C. Arny and R. W. Thatcher; Heating Seed Rooms to Destroy Insects, by E. G. Montgomery; The Effect of Sodium Nitrate Applied at Different Stages of Growth on the Yield, Composition, and Quality of Wheat, by J. Davidson and J. A. LeClerc; and A New Device for Harvesting Grass and Grain Plots, by A. G. McCall.

The committee on soil classification and mapping made several suggestions for future work. The committee on the standardization of field experiments

suggested the compiling of a bibliography on the subject of field experiments. The committee on agronomic terminology reported that it is submitting a glossary of terms through the *Journal of the American Society of Agronomy* for the approval of the society.

The committee on varietal nomenclature suggested the creation of a register of varieties, along the lines followed in the herd-books, giving the history, ancestors, etc., of the variety. E. G. Montgomery, chairman of the committee, discussed some work that had been done along these lines in the classification of oats at the Cornell Station, and exhibited some mounted specimens.

The following officers were elected for the ensuing year: President, W. M. Jardine; Vice-Presidents, J. G. Lipman and J. A. Foord; Secretary, C. W. Warburton; and Treasurer, George Roberts.

American Association for the Advancement of Agricultural Teaching.—The seventh annual meeting of this association was held in Washington, D. C., November 14, 1916. Two main topics were presented for discussion, the content of the course in the college of agriculture for prospective high school teachers of agriculture and the high school course in agriculture.

Under the first of these, Dean C. F. Curtiss discussed the relation of the sciences. He thought that the science taught ought to be applied science, which will directly connect up with the work of the farmer and the community in which the teachers will serve.

As to general professional subjects, K. L. Hatch held that psychology is the basis of the professional preparation, but that whether or not there should be a course in general education is doubtful. The student's time is so taken up with technical work in agriculture that an effort should be made to reduce the professional preparation to the minimum. The course in agricultural education ought to include the principles of general methods. A certain amount of practice work should be required with real students, with real classes and conditions, and with problems teachers are going to meet. Professor Hatch also discussed at length the growing demand for a course in the college known as general science or elementary science. In discussing this paper R. W. Stimson laid stress upon the importance of training college teachers of agriculture, if for no other reason than that the prospective teachers coming under their influence may imitate good teaching.

G. A. Works took up The Content of the Methods Course for High School Teachers of Agriculture, outlining the work given in the New York State College of Agriculture. This course, which is given three or four times a year, is open only to seniors. It runs for a term with two discussion periods and one laboratory period 2½ hours in length each week. The class is limited to 50 and each laboratory section to 12 students. The laboratory and lecture work are closely correlated throughout the course, and special attention is given to the selection of material adapted to the high school pupil and to its arrangement in seasonal sequence. Other topics taken up are the place of the home project and the organization of study material for the recitation lesson, the laboratory, and the field trip. A visit to a near-by high school is made for the purpose of studying equipment, library, and home projects, and some work is done in chart making and bulletin collecting and cataloguing.

The Relations of High School Agriculture to Agriculture as Taught in the Lang-grant College, was the title of a paper read by D. J. Crosby, in which the subject was discussed along the lines of the report of the committee on instruction in agriculture of the Association of American Agricultural Colleges and Experiment Stations (E. S. R., 35, p. 705).

In a paper on How to Connect the High School Work with Practical Farm Operations, A. K. Getman suggested (1) a seasonal distribution of the topics

studied, the study to coincide with the operations on the farm, (2) provision for field and laboratory work, and (3) the use of the home project properly planned, accounted, summarized, and supervised.

C. H. Lane, in a paper on The Content of High School Courses in Agriculture, said that it is not merely a question of what is worth teaching and studying, but what is best considering all local conditions, equipment, time, teacher, community interests, adaptations, etc. Thus, the determination of the content and arrangement of a course in agriculture becomes a local problem and no general solution can be given that will apply equally well to all localities. The following outline of work was, however, suggested: First year, practical work on how plants grow, soils and fertilizers, and field crops or fruits and vegetables, the choice depending upon local conditions as regards available material and interest in home project work. The second year should be given to the study of live stock. After such general courses the student is prepared for more special work. In sections where horticulture is important the third year may well be spent in such specialized branches of plant production as fruit growing, practical work on soils and fertilizers, cover crops, etc., as relate to the production of fruit, or market or vegetable gardening, and one-third of a unit on improvement of home grounds and ornamental planting.

Similar specialized courses should be provided in districts where one or more field crops, dairying, or some other special phase of animal husbandry prodominates. In districts having broad interests in agriculture the school should be equipped to offer a number of special courses during the third and fourth years. While the subject of tools, implements, and machinery is necessarily considered in connection with crop production, the subject of farm mechanics is deemed sufficiently important to receive special attention during the fourth year. A half unit in rural economics and farm management should not preclude careful accounting in connection with the projects of each of the previous years nor the study of simple methods of accounting in connection therewith.

The officers elected for the ensuing year are W. H. French, Michigan Agricultural College, president; A. C. Monahan, U. S. Bureau of Education, vice-president; and C. H. Lane, U. S. Department of Agriculture, secretary-treasurer.

Agricultural Education at the Fourteenth International Live Stock Exposition.—After a lapse of three years, occasioned by the foot-and-mouth disease situation, the Fourteenth International Live Stock Exposition was held at Chicago in December, 1916. The agricultural colleges were again strongly in evidence, both the grand champion and the reserve champion in the bullock section coming from the University of California.

A new feature of the show is to be a special exhibit each year from some one agricultural college. The institution selected to initiate this practice was the University of Illinois, which depicted in miniature its campus and buildings and likewise a model farm divided into fields supporting a profitable and soil building rotation as well as much other illustrative material. A number of domestic science demonstrations were also given by the Iowa College, while the U. S. Department of Agriculture showed moving pictures of agricultural interest.

At the students' stock-judging contest, 16 institutions were represented, three for the first time. The first place was awarded to the team from Purdue University, second to the Iowa State College, and third to the Ohio State University.

Colonization of Ex-soldiers and Sailors in England.—An estate of 2,363 acres, near Patrington in Yorkshire, has been acquired for a land settlement colony of ex-service men. When fully developed the colony will comprise a central

farm of about 200 acres and 60 small holdings of about 35 acres each. On each of these holdings, a cottage and the necessary farm buildings will be built, while the central farm will be equipped with machinery, horses, etc., which may be hired by the settlers.

Applicants will receive training when necessary on the central farm until fitted to take up a holding independently. Cooperative methods are to be followed in the purchase of supplies and the disposal of produce for the entire tract. The enterprise is said to be the first of its kind in Great Britain. R. N. Dowling, organizer of agricultural education to the Lindsey County Council of Lincolnshire, has been appointed director of the colony.

Miscellaneous.—Following the death of Hon. James S. Duff, Minister of Agriculture for Ontario, the Prime Minister, Hon. W. H. Hearst, has taken charge of that department in addition to his other duties. President G. C. Creelman of the Ontario Agricultural College has also been appointed commissioner of agriculture for the Province, a new position in which he will act as chief adviser to the Prime Minister on matters of agricultural policy.

The Kaisar-i-Hind Medal of the First Class, conferred for public services in India, was bestowed on New Year's Day upon Dr. H. H. Mann, principal of the Agricultural College of Poona and agricultural chemist to the Government of Bombay.

William Marriott, assistant secretary of the Royal Meteorological Society from 1872 to 1915, and editor of the *Meteorological Record* from 1881 to 1911, as well as a frequent contributor to other meteorological publications, died at Dulwich, England, December 28, 1916, at the age of 68 years.

Valparaiso University, located at Valparaiso, Ind., has received a gift of 400 acres of land, valued at over $50,000, from William F. Pinney and Miss Myra Pinney for the use of its department of agriculture.

J. A. McLean, formerly of the Massachusetts College, has been appointed professor of animal husbandry in the University of British Columbia, and has entered upon his duties.

Plans are under consideration for the establishment by the Board of Agriculture and Fisheries and the Board of Development Commissioners of Great Britain of a research institute for problems relating to agricultural machinery at Cambridge University in connection with the existing schools of agriculture and engineering.

Officers for the current year were elected by the American Phytopathological Society at its New York City meeting, December 27–30, 1916, as follows: President, M. T. Cook of the Delaware station; vice president, Charles Brooks, U. S. Department of Agriculture; councilor, H. S. Jackson of the Indiana station.

F. A. Stockdale, director of agriculture in Mauritius, has been appointed director of agriculture in Ceylon and has been succeeded by Dr. H. A. Tempany, chemist and superintendent of agriculture in the Leeward Islands.

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U. S. DEPARTMENT OF AGRICULTURE.

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EXPERIMENT STATION RECORD.

VOL. 36. ABSTRACT NUMBER. No. 3.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Chemical composition of alfalfa as affected by stage of maturity, mechanical losses, and condition of drying, C. O. SWANSON and W. L. LATSHAW (*Jour. Indus. and Engin. Chem., 8 (1916), No. 8, pp. 726–729*).—From a study of the chemical composition of alfalfa as affected by variations in maturing and curing, the authors have found at the Kansas Experiment Station that alfalfa cut in the bud stage has the largest ash and crude protein and the smallest crude fiber and nitrogen-free extract content. "In each successive stage the crude fiber and nitrogen-free extract increases, and the crude protein and ash decrease. In pounds per ton the alfalfa cut in the earlier stages has more of crude protein and less of crude fiber. The total amount of any or all nutrients produced per acre depends to a large extent on the yield.

"The leaves and stems differ in content of ash, ether extract, and nitrogen-free extract, but the greatest difference is in the percentage of crude protein and crude fiber. The leaves contain over two and a half times as much protein as the stems, while the stems contain over two and a half times as much crude fiber as the leaves.

"In harvesting and handling there is a large loss of leaves, which loss affects the composition of the hay in an increase of crude fiber and a decrease of crude protein. The alfalfa cured in the sun has a larger pure protein content, as determined by Stutzer's method, than that cured in the shade. This difference is so great as to more than offset the influence of the loss of leaves. The differences in respect to pure protein content were most pronounced in the alfalfa cut in the earlier stages."

The chemical composition of Oscillaria prolifica, B. B. TURNER (*Jour. Amer. Chem. Soc., 38 (1916), No. 7, pp. 1402–1417, figs. 5*).—The air-dried material examined was found to have the following percentage composition: Moisture, 9.7 per cent; protein, 46.25; ether extract, 2.2; fiber and nitrogen-free extract, 35.5; and ash, 6.4 per cent (a small part due to fine sand unavoidably collected with the alga).

By extraction with various solvents no crystalline and easily identified characteristic substances were found in any considerable quantity in the alga. A small quantity of a crystalline magnesium salt of an organic acid (possibly caproic) was obtained. Saponin was not obtained in any appreciable quantity. A glucosid or a polysaccharid having physical properties similar to saponin was, however, detected.

"The bad smell and taste of the decaying alga appears to be due largely to higher acids of the fatty (butyric) series, some of which were separated; indol

or skatol from decomposition of the proteins seems also to be present in traces. The fresh alga contains an aromatic compound soluble in petroleum spirit which causes a characteristic odor. The spectra have been determined of various coloring matters from the alga, a 'chlorophyll' similar to that of the higher plants, and a blue substance soluble in water and in glycerol, with an intense red fluorescence, having properties which indicate that it is either associated with and carried down by the proteins in solution or itself has similar precipitation properties. This substance, which is believed to be new and may be allied chemically to the chlorophyll of the alga, has been named 'algocyan.'"

The principal carbohydrate found was a pectin-like substance, insoluble in water, which on heating formed a jelly. It was slowly hydrolyzed by 5 per cent sulphuric acid. On examination of the hydrolytic products the presence of a nonreducing substance with a high positive rotation and a reducing sugar with a smaller rotation was indicated. A small quantity of a phenyl hydrazin compound, melting point 217° C., containing about 11 per cent of nitrogen was also obtained, but could not be identified with any known compound.

A modification of the Kjeldahl method for the determination of nitrogen, in which as little as from 5 to 10 mg. of sample and containing 1 mg. or less of nitrogen can be used, has been devised and is described in detail. A new form of extraction apparatus suitable for a continuous extraction with large quantities of material is also described.

Barium in tobacco and other plants, Bonnibel Artis and H. L. Maxwell (*Chem. News, 114 (1916), No. 2959, pp. 62, 63*).—Using the method for the determination of barium in plant materials essentially as described by McHargue (E. S. R., 30, p. 502), the authors report the following percentages of barium (as $BaSO_4$) in the materials examined: Havana tobacco from Cuba, leaf 0.0608, stem 0.076; broadleaf tobacco grown in Pennsylvania, leaf 0.0648, stem 0.078; Havana tobacco grown in Connecticut, leaf 0.06, stem 0.072; Pennsylvania tobacco, leaf 0.098, stem 0.128; Sumatra tobacco, leaf 0.0308, stem 0.0408; Wisconsin tobacco, leaf 0.0192, stem 0.028; tobacco grown in New York, leaf 0.0132, stem 0.504; dogwood leaf 0.0224; cottonwood leaf 0.0052; cherry leaf 0.0392; black-locust leaf 0.0324; mulberry leaf 0.0696; elm leaf 0.0356; linden leaf 0.0152; wild-olive leaf 0.0048; plum leaf 0.0372; box-elder leaf 0.036; hard-maple leaf 0.0368; walnut leaf 0.0752; and pear leaf 0.0196. The following results were obtained in the examination of immature leaves gathered in May soon after their appearance: Soft maple 0.0273; wild grape 0.0941; wild cherry 0.0336; box elder 0.0295; cottonwood 0.0528; lime 0.0435; cherry 0.0134; elderberry 0.0143; black walnut 0.0096; sumac 0.0071; elm 0.0182; and blackberry 0.0086.

The percentage of ash in the tobaccos analyzed is also reported.

The synthesis of a new tripeptid, glycocyamilglycylglycin (guanidoglycylglycylglycin), A. Clementi (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 25 (1916), I, No. 12, pp. 806–811*).—The author describes the preparation of the new tripeptid from diglycylglycin and cyanamid.

The isomeric pentacetates of glucosamin and of chondrosamin, C. S. Hudson and J. K. Dale (*Jour. Amer. Chem. Soc., 38 (1916), No. 7, pp. 1431–1436*).

The optical rotatory powers of some acetylated derivatives of maltose, cellose, and lactose, C. S. Hudson and R. Sayre (*Jour. Amer. Chem. Soc., 38 (1916), No. 9, pp. 1867–1873*).

An automatic pipette, A. Lowy (*Jour. Indus. and Engin. Chem., 8 (1916), No. 8, pp. 734, 735, figs. 3*).—An automatic stopcock pipette is described in detail. Advantages claimed for it are that an exact measured volume of liquid drawn into the pipette can be controlled automatically by the operator; that the necessity of adjusting, maintaining, and manipulating the exact volume of the liquid

after it has passed above the graduation mark is obviated; and that it is exceedingly easy to manipulate.

The determination of aluminum as oxid, W. BLUM (*Jour. Amer. Chem. Soc., 38 (1916), No. 7, pp. 1282–1297, figs. 2*).—From experiments reported it was found with a hydrogen electrode and suitable indicators that the precipitation of aluminum hydroxid by ammonium hydroxid is complete when [H+] ranges from $10^{-6.5}$ to $10^{-7.5}$. These points are approximately defined by the color change of methyl red and rosolic acid. The presence of ammonium chlorid is advantageous in controlling the alkalinity and in coagulating the precipitate. Solutions of ammonium nitrate and chlorid are equally satisfactory for washing the precipitated hydroxid. For the determination of aluminum the following procedure is recommended:

To the solution containing at least 5 gm. of ammonium chlorid per 200 cc. (or an equivalent amount of hydrochloric acid) a few drops of methyl red are added and the solution then heated just to boiling. Ammonium hydroxid is carefully added until the color of the solution changes to a distinct yellow. Boiling is continued for one or two minutes and the precipitate filtered at once and washed thoroughly with hot 2 per cent ammonium chlorid or nitrate solution. The hydroxid is ignited in a platinum crucible and after all the carbon is burnt off is blasted for five minutes. The crucible is then covered and placed in a desiccator until cool. After weighing, a second blasting of five minutes is desirable, as it permits of a more rapid weighing and, consequently, more accurate results.

It is indicated that the crucibles containing the ignited alumina should be kept covered in the desiccator and on the balance. Five or 10 minutes blasting is sufficient for precipitates containing from 0.1 to 0.2 gm. aluminum oxid. The presence of ammonium chlorid during ignition causes no appreciable loss of alumina.

Notes on the determination of aluminum, C. F. SIDENER and E. PETTIJOHN (*Jour. Indus. and Engin. Chem., 8 (1916), No. 8, pp. 714–716*).—Experimental data submitted show that boiling the solution for one minute completely precipitates all aluminum present, and that longer boiling may lead to a re-solution of part of the precipitate. The complete removal of ammonium chlorid from the precipitate before ignition was found not to be necessary. A great excess of ammonium hydroxid should be avoided during precipitation and should never be more than 1 or 2 cc. per 250 cc. of solution. When the precipitate is large it must be blasted for 40 minutes to insure its being reduced to a constant weight, as the ignited alumina is strongly hygroscopic. See also a previous note by Daudt (E. S. R., 34, p. 205) and that by Blum, noted above.

A study of the silver arsenate test for arsenic, L. J. CURTMAN and P. DASCHAVSKY (*Jour. Amer. Chem. Soc., 38 (1916), No. 7, pp. 1280–1282*).—The authors have found that with pure solutions of arsenate the test with silver nitrate is sensitive to 0.02 mg. of arsenic. Ammonium nitrate was found to have no influence on the detection of 0.2 mg. of arsenic as sodium arsenate. A procedure in which the test is capable of detecting 0.5 mg. of arsenate with certainty is outlined.

Titrametric determination of nitrites, B. S. DAVISSON (*Jour. Amer. Chem. Soc., 38 (1916), No. 9, pp. 1683–1687, fig. 1*).—The author, at the Ohio Experiment Station, reviews the earlier methods for the titrametric determination of nitrites and outlines a procedure based on the nitrous acid-potassium iodid reaction. A special form of aeration flask used in the method is described.

Analytical data submitted indicate the accuracy of the modified procedure. Organic matter in soil extracts does not materially affect the results. When

necessary, however, the nitrites may be removed from a second portion of the sample by boiling with acetic acid and the effect of the organic matter determined by a blank titration.

It is concluded that "nitrous nitrogen can be determined titrametrically when care is taken to expel the air from the titration flask with some gas which will not affect the determination."

Notes on soil analysis, K. GEDROITS (*Zhur. Opytn. Agron.*, *16* (*1915*), *No. 1, pp. 83–94*).—The determination of the loss in soils which do not contain carbon dioxid, alkalis, and chlorids of metals by calcination at temperatures from 530 to 560° C. showed that within these limits the higher the temperature the smaller was the loss. The same phenomenon was observed for soils in general.

Determination of the loss by calcination for soils containing calcium carbonate and chlorids of metals showed during a period of one hour at the temperature noted above the same results as calcination of soils not containing these substances. If the soils contained magnesium carbonate in addition to the above, the procedure could not be used on account of the decomposition of magnesium carbonate. The determination is rendered still more difficult if in addition to magnesium carbonate the soil contains considerable quantities of chlorids, as the effect of high temperature on the latter will depend on their composition and on the composition of the soil, containing possibly sodium, magnesium, calcium, and other chlorids. Calcium and magnesium chlorids are not volatilized on heating but may be decomposed to a greater or lesser extent, especially magnesium chlorid, on account of the hydrolytic action of the water in the soil. Sodium chlorid is volatilized entirely by heating over the flame of a Teclu burner.

It is indicated that the processes taking place in the soil during calcination are not clearly understood. The temperature of heating should apparently be from about 530 to 560°.

Decomposition of a soil containing sulphates by means of hydrofluoric acid is a very disagreeable operation on account of the necessity of evaporating the excess of sulphuric acid, and experiments were made in which hydrochloric acid was substituted for sulphuric acid. To 5 gm. of a fine black loam soil in a platinum dish was added 25 cc. of fuming hydrofluoric acid (38 to 40 per cent), and the mixture evaporated slowly to dryness on the water bath. To the dry residue 15 cc. more of the acid was added and 25 cc. of hydrochloric acid (specific gravity 1.19) and the mixture again slowly evaporated. The latter process was repeated a second time, when complete decomposition of the mineral substance was obtained. In order to remove the hydrofluoric acid completely the residue was treated four or five times with hydrochloric acid in a boiling water bath, dried, transferred to a suitable container, heated with hydrochloric acid, filtered through an ashless filter, and carefully washed with hot water and a weak solution of hydrochloric acid. The filtered residue was then treated with more hydrochloric acid and nitric acid, and the filtrate was neutralized in the usual manner and found to contain aluminum, potassium, phosphorus, and traces of calcium.

The determination of the alkalinity and phosphoric acid content in the ash of foodstuffs, I. M. KOLTHOFF (*Chem. Weekbl.*, *13* (*1916*), *No. 33, pp. 910–914*).—The author briefly reviews the method described by Farnsteiner (E. S. R., 18, p. 1107) and indicates some disadvantages in its use.

For the determination of the alkalinity of the ash the following procedure is described: From 0.2 to 0.3 gm. of ash are treated with hydrochloric acid as in the method of Farnsteiner, filtered, and the filtrate neutralized with tenth-normal sodium hydroxid. A solution containing 0.25 gm. of neutral potassium oxalate and a solution containing the same amount of sodium chlorid are then

added, and the liquid is titrated with standard alkali, using phenolphthalein as an indicator.

Formulas for calculating both the alkalinity and the phosphorus content of the ash are included.

Comparative analytical data obtained in the examination of cocoa and pepper are also submitted.

Pomace wines: Their composition and detection, J. R. Eoff, Jr. (*Jour. Indus. and Engin. Chem., 8 (1916), No. 8, pp. 723–726*).—This article briefly discusses the manufacture of pomace wines and submits detailed analytical data of a number of white and red pomace wines, together with analytical data of two pure Catawba wines. The analytical data include determinations of alcohol by volume, reducing sugar as invert, nonsugar extract, glycerol, total acidity as tartaric, volatile acid as acetic, fixed acid as tartaric, free tartaric acid, cream tartar, combined tartaric acid, tannin and coloring matter, pentosans, volatile esters, and ash, and a complete mineral analysis of the ash.

The nonprotein nitrogenous constituents of feeding stuffs, H. S. Grindley and H. C. Eckstein (*Jour. Amer. Chem. Soc., 38 (1916), No. 7, pp. 1425–1431*).—An aqueous extract of alfalfa hay, timothy hay, blood meal, corn, and clover hay from which the water-soluble native protein was precipitated by colloidal ferric hydroxid was examined for its nonprotein nitrogenous constituents, and the analytical results are submitted in detailed tabular form.

The data show that the nonprotein nitrogenous constituents consist largely of the forms of nitrogen that result from the decomposition of proteins by hydrolysis. The sum of the amid, humin, free and combined amino, and free and combined acid-amid nitrogen represented in the nonprotein nitrogenous constituents form from 80 per cent in alfalfa hay to 94 per cent in blood meal of the nonprotein nitrogen.

It is deemed probable that "only a small part . . . of the nonprotein nitrogenous constituents of foods and feeding stuffs can in any way interfere with the application of the Van Slyke method for the determination of the chemical groups characteristic of the different amino acids of protein to the estimation of the free and combined amino acids and amids of feeding stuffs."

The so-called amid nitrogen of feeding stuffs is largely composed of free amino acids and peptid linkings. These forms, including the humin nitrogen, constitute about 53 to 63 per cent of the water-soluble nitrogen not precipitated by the colloidal ferric hydroxid. The free ammonia varied from 6.33 to 12.44 per cent of the water-soluble nitrogen not precipitated by the ferric hydroxid.

See also a previous note by Hart and Bentley (E. S. R., 34, p. 501).

A new sensitive method for the analysis of oils, A. Mazzaron (*Staz. Sper. Agr. Ital., 48 (1915), No. 8, pp. 583–594*).—The author describes a new constant for use in the examination of oils which depends on the determination of the sulphur dioxid liberated after treatment of the oil with concentrated sulphuric acid.

The procedure consists of treating 20 cc. of the oil with 5 cc. of concentrated sulphuric acid (specific gravity 1.84), thoroughly shaking for about a quarter of a minute, and aspirating the liberated sulphur dioxid into a standard tenth-normal iodin solution, passing a current of air through the oil and acid mixture during the reaction. The reaction is carried out at 20° C., and when complete the iodin used is determined by titrating the excess with standard sodium thiosulphate. The number of cubic centimeters of tenth-normal iodin required to oxidize the sulphur dioxid liberated from 20 cc. of the oil is termed the sulphur-dioxid number of the oil.

The following figures for oils examined are submitted: Olive oil, 2.4; sesame oil, 49.5; cottonseed oil, 137.5; maize oil, 65; soy-bean oil, 223; rape oil, 15;

and peanut oil, 7. From comparative data submitted there appears to be no definite relation between the new sulphur-dioxid number and the Maumené number.

I, Soy bean oil. II, Flax studies, W. F. Washburn (*North Dakota Sta. Bul. 118 (1916), pp. 35–48*).—Part 1 of this bulletin contains tabulated analytical data of the percentage of crude ether extract, Hanus iodin number of the oil, saponification value at 25° C., refractive index at 25°, specific gravity at 15.5°, and the color of the oil of some 45 varieties of soy beans grown in a number of States under various climatic conditions. The samples examined included the crops of 1912, 1913, and 1914.

It is indicated, in general, from the data that no definite conclusions could safely be drawn as to the effect of climatic conditions on the content and quality of oil of different varieties of beans until the beans had been grown at least three years in the same locality.

Exposure tests to determine the value of the oil as a paint vehicle are in progress.

Part 2 contains data obtained from the examination of various strains of flaxseed, relative to the percentage content of moisture, protein, and oil and the drying quality of the oil. Further data of the percentage content of moisture and oil and iodin number, saponification number, refractive index at 25°, specific gravity, and acid number of the oil obtained from immature and high-grade flaxseed and from various strains of seed grown and harvested under the same conditions, and also from the seed of flax which had been allowed to become wet and injured to some extent after the harvest, are also submitted.

The volatile oil of Calycanthus occidentalis, C. C. Scalione (*Jour. Indus. and Engin. Chem., 8 (1916), No. 8, pp. 729–731*).—The oil distilled from the leaves and twigs of the plant possessed a greenish color, bitter taste, and camphoraceous odor. The following constants were determined: Density at 25° C., 0.9295; rotation, +7° 28′; index of refraction at 20°, 1.4713; free acid, 0.05 per cent; saponification value, 54.3; and acetyl value, 33.5. The oil was found to be soluble in all proportions in 90 per cent alcohol, and in from 15 to 16 volumes of 70 per cent alcohol by volume.

Seven fractions, the boiling points of which ranged from 154° to 220° and over, were obtained by fractional distillation. From the examination of these fractions the following percentage composition is given for the oil: Pinene (*d* and *l*), 8.3; cineol, 60.32; borneol, 9.21; camphor, ?; methyl salicylate, ?; linalyl acetate, 18.99; sesquiterpene alcohols, ?.

Volatile oil of Euthamia caroliniana, G. A. Russell (*Jour. Amer. Chem. Soc., 38 (1916), No. 7, pp. 1398–1402*).—The oil examined was distilled from the fresh herb gathered just previous to the flowering stage. The yield obtained calculated with reference to the fresh material was 0.693 per cent. The oil was pale yellow in color and possessed a pleasant aromatic odor. The following physical and chemical constants were obtained: Specific gravity at 23° C., 0.8587; index of refraction, 1.4805; angle of rotation at 23°, −10° 48′; saponification value, 6.35 (equivalent to 2.1 per cent esters calculated as acetate); acetyl value, 25.3 (equivalent to 7.01 per cent of alcohol in the original oil); and ester number, 6.35. The oil was readily soluble in six volumes of 90 per cent alcohol and clearly soluble in an excess. Qualitative tests for phenols were negative, while a small amount of aldehydes was detected in the oil.

The original oil was fractionated into three fractions, and after first being saponified fractionated into six fractions. The analytical results obtained from an examination of these fractions are submitted in detail. It is indicated that the oil consists mainly of dipentene with a trace of pinene and possibly a small amount of limonene. Although the oil had been distilled and stored for 15

months, no free acids were present, but there was a small percentage of combined acids, probably formic and acetic. Of the 7.01 per cent of alcohol present 5.35 per cent was free and 1.66 per cent combined.

Relative oil yield of Florida oranges, S. C. Hood (*Jour. Indus. and Engin. Chem., 8 (1916), No. 8, pp. 709–711*).—From a study of the commercial possibilities of the manufacture of orange oil from Florida cull oranges a wide variation in the yield of oil of oranges under different climatic and cultural conditions was observed. "The oil content has not reached its maximum until the oranges are fully mature, but the oil is present in commercial quantities before the fruit are ready for harvest. The occurrence of heavy rainfall during the season of harvest will cause a considerable decrease in the oil content. The presence of rust mite does not decrease the percentage yield of oil of the mature fruit, but may show some effect early in the season."

Studies on the extraction of rosin from wood.—I, Experiments using a petroleum solvent, R. C. Palmer and H. R. Boehmer (*Jour. Indus. and Engin. Chem., 8 (1916), No. 8, pp. 695–701, figs. 7*).

A numerical expression for color as given by the Ives tint photometer, O. Kress and G. C. McNaughton (*Jour. Indus. and Engin. Chem., 8 (1916), No. 8, pp. 711–714, figs. 8*).—This article reports preliminary experimental data of a study to determine the possibility of using the Ives tint photometer as a measure of the progress of beating in paper milling and to observe the relation between the numerical expressions for depth of color as read from the instrument and the relation of the shades as noted by the eye.

The results obtained are expressed in graphic form.

METEOROLOGY.

The problems of agricultural meteorology, G. Azzi (*Bol. Min. Agr. e Indus., Com. ed Lavoro [Rome], Ser. B, 15 (1916), II, No. 5–8, pp. 38–47*).—This article discusses in some detail the elements necessary for the solution of the problems of agricultural meteorology, the organization and equipment of agricultural meteorological stations, methods, and forms to be used in reporting observations on the relation of plant growth to meteorological conditions, and methods of determining the critical period and forecasting the growth and yield of plants under different conditions of culture and climate.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 3 (1916), Nos. 9, pp. 222, pls. 2, figs. 4; 10, pp. 224, pls. 2, figs. 5*).—These volumes contain, respectively, brief summaries and detailed tabular statements of climatological data for each State for September and October, 1916.

Annual report of the Weather and Crop Service for 1915, G. M. Chappell (*Iowa Yearbook Agr., 16 (1915), pp. 593–643, figs. 3*).—This report includes summaries of the monthly and weekly bulletins issued by the Iowa Weather and Crop Service in cooperation with the Weather Bureau of the U. S. Department of Agriculture. It shows that the average temperature for the State during the year 1915 was 47.8° F.; the average precipitation 39.53 in., or 7.56 in. above the normal; and the average snowfall 31.3 in.

"The striking features of the year were the remarkably cool summer, the frequency of showers during the crop season, the excessive cloudiness, the killing frost and freezing temperatures over the northeastern counties in August, and the fact that frost occurred at some place in the State every month of the year. The summer was the coolest of record, there being an average deficiency of temperature of 4.8° per day from May 1 to September 30, inclusive. Showers were frequent and many of them heavy, which delayed

corn planting and replanting, washed out many acres of corn, prevented or interfered with haying and harvesting, and ruined much of the hay and grain that had been cut. The cool, wet, and cloudy weather prevented the normal development of corn, and as a result two-thirds of the crop was not fully matured at the time of the first killing frost. The yield of practically all crops was, however, nearly up to the normal, but the quality of staple field crops was far below the normal, so that the year as a whole was one of the worst, if not the worst, in the history of the State."

The report also contains notes on fungus diseases in 1915, by L. H. Pammel, with special reference to the relation of the weather conditions to the prevalence and virulence of such diseases.

Meteorological record, 1915 (*Montana Sta. Rpt. 1915, p. 260*).—A summary by months is given of observations at Bozeman, Mont., on temperature, precipitation, cloudiness, and winds. The highest temperature recorded was 90° F., August 30; the lowest, —17°, December 30. The mean temperature for the year was 41.68°. The annual rainfall was 24.72 in. The last killing frost in the spring occurred May 16; the first in the fall, September 14. The number of clear days was 144. The number of days with 0.01 in. or more of rain was 120. The prevailing direction of the wind was southeast.

The phenology of Nova Scotia, 1915, A. H. MACKAY (*Proc. and Trans. Nova Scotian Inst. Sci., 14 (1915–16), No. 2, pp. 133–140, fig. 1*).—This article gives the average dates (phenochrons) of various phenomena of wild life and of agricultural operations for each of the 10 biological regions of the Province and for the Province as a whole. These are based upon 350 of the best schedules of observations "made in the schools of the Province of Nova Scotia as a part of the nature study work prescribed."

[Results of meteorological and soil temperature observations], A. A. RAMBAUT (*Oxford: Humphrey Milford, 1916, pp. XV+215, pls. 4; rev. in Nature [London], 98 (1916), No. 2457, pp. 247, 248*).—This report gives the results of observations at Radcliffe Observatory, Oxford, on pressure, temperature, precipitation, wind, clouds, and other phenomena during 5 years—1911 to 1915—and on temperature at different depths in the soil during 12 years—1898 to 1910. The soil temperature observations were made by means of platinum resistance thermometers.

A comparison of the soil temperatures with the air temperatures shows clearly the retardation of phase as well as the dimunition in amplitude in the passage of any oscillation of temperature from the surface to a depth of 10 ft. in the soil. There was found to be "a general falling off in the mean temperature amounting to about 2° during the period of 12 years over which the observations extend."

Swedish meteorological observations, 1914 (*Met. Iakttag. Sverige (Observ. Mét. Suéd.), Met. Centralanst., 56 (1914), pp. XII+175*).—These are the usual meteorological summaries of observations made under the direction of the Central Meteorological Institute of Sweden.

The distribution of precipitation in north Germany, G. HELLMANN (*Sitzber. K. Preuss. Akad. Wiss., 1914, XXXVIII, pp. 980–990, figs. 2*).—The mean annual rainfall of the region during 20 years is shown to have been 638 mm. (25.1 in.), the lowest mean at any point being 416 mm. and the highest 1,700 mm.

Thunder and hail in the region of Paris, A. ANGOT (*Compt. Rend. Acad. Agr. France, 2 (1916), No. 31, pp. 912, 913*).—The record of the occurrence of thunder and hail in this region from 1874 to 1913 is given. This indicates that there is no relation between hail and electric phenomena.

The climate of western and equatorial Africa, R. CHUDEAU (*Ann. Géogr. 25 (1916), No. 138, pp. 429–462, figs. 12*).—This region is divided into three

climatic zones, of which the characteristic conditions of physiography, temperature, pressure, winds, humidity, evaporation, and rainfall are described, with a brief note on tornadoes and a short description of the more general climatic characteristics of the region.

The correlation of rainfall and the succeeding crops with special reference to the Punjab, S. M. JACOB (*Agr. Jour. India, Indian Sci. Cong. No., 1916, pp. 86–102, pls. 11*).—Studies of the relation between the July, August, September, and October rainfall and area sown to crops and between the September-March rainfall and the yield of crops are reported. These studies were made as a necessary preliminary to the successful forecasting of the total crop production. The studies are based on 30 years' (1886 to 1915) observations on irrigated wheat, unirrigated wheat and gram, and all other unirrigated crops. The general outcome of the application of the various correlations observed was an error of prediction for the area of irrigated wheat of 5.6 per cent of the mean; of unirrigated crops 9 per cent of the mean.

The Kincer method of prediction of yield of cotton, based on the assumption that the best conditions are the normal ones (E. S. R., 33, p. 117), was applied to unirrigated wheat. "The weighted rainfall in each month was added together, and a coefficient of benefit B obtained, and this was correlated with the area of unirrigated wheat for 1900 to 1915. The correlation is -0.91, even higher than Kincer's figure of 0.88. The formula giving the percentage of failure in terms of the coefficient B is $K=24.2-0.35B$." The agreement of the values shown by this formula is, in the opinion of the author, very good and "affords a posteriori justification of the hypothesis. The introduction of suitable corrections for other climatic factors, such as temperature, sunshine, evaporation, precipitation in the form of dew, wind, and the like would improve the prediction still further."

The climatic control of Australian production, G. TAYLOR (*Commonwealth Bur. Met. Aust. Bul. 11* [*1916*], *pp. 32, pls. 7, figs. 10; rev. in Scot. Geogr. Mag., 32* (*1916*), *No. 10, p. 487*).—The distribution and production of cattle, sheep, and wheat with reference to climate is discussed. This seems to depend mainly upon the rainfall, particularly in the case of wheat. Temperature is also a limiting factor in the case of wheat, but less so in the case of cattle and sheep.

It is shown that the most intensive cattle production occurs in the eastern and wetter (over 20 in. of annual rainfall) parts of the country, and that the greatest sheep production occurs in areas having from 15 to 20 in. of rainfall. The relation of wheat growing to temperature and rainfall in the different Australian States is shown in the following table:

Relation of temperature and rainfall to wheat production in Australia.

Wheat belt.	Temperature.			Rainfall.		
	Annual.	April–October.		Annual.	April–October.	
		Whole area.	Best area.		Whole area.	Best area.
	Degrees F.	*Degrees F.*	*Degrees F.*	*Inches.*	*Inches.*	*Inches.*
Western Australia	70–60	63–57	62–57	40–10	30–10	20–15
South Australia	67–58	58–54	57–55	30–10	25–6	20–10
Queensland	68–65	62–60	....	40–23	20–10	....
New South Wales	67–56	61–52	61–52	45–14	25–9	15–11
Victoria	63–55	55–52	55–52	40–12	25–8	15–10
Tasmania	56–50	52–46	....	60–19	40–10	25–10

SOILS—FERTILIZERS.

The present status and future development of soil classification, G. N. Coffey (*Jour. Amer. Soc. Agron., 8 (1916), No. 4, pp. 239–243*).—An outline of the present status of soil classification is given, it being pointed out that "the tendency at the present time is to develop a system of classification based upon actual differences in the character of the soil itself. . . . For the working out of such a system in detail it is essential to have a knowledge not only of the peculiarities and differences in soils but also the relative importance of these in terms of crop production."

Field operations of the Bureau of Soils, 1913 (fifteenth report), M. Whitney et al. (*U. S. Dept. Agr., Field Operations Bur. Soils, 1913, pp. 2438, pls. 43, figs. 62, maps 54*).—This report contains a general review of the field operations of the Bureau of Soils during 1913 by the chief of the Bureau, together with detailed accounts of 53 surveys which have already been noted in the Record. During the calendar year 1913 a total area of 31,676 square miles, or 29.272,640 acres, were surveyed and mapped in detail, making the total area surveyed and mapped up to the end of that year 315,794 square miles, or 202,108,160 acres. There were also conducted reconnoissance surveys covering an area of 15,917 square miles, or 10,186,880 acres.

[Soil analyses] (*Biol. Agr. [São Paulo], 17. ser., No. 4–5 (1916), pp. 337–344*).—Chemical analyses of 79 samples of different soil types of the State of São Paulo, Brazil, are reported and discussed.

Water penetration in the gumbo soils of the Belle Fourche Reclamation Project, O. R. Mathews (*U. S. Dept. Agr. Bul. 447 (1916), pp. 12, figs. 4*).—Studies of the rate of flow of water in very heavy clay gumbo soils of residual origin when loose and saturated and when wet and dry under field conditions are reported.

These soils are said to be highly productive, with large water capacity, but the large content of clay makes them subject to extreme changes in volume with changes in water content. Three-in. samples of the soil to a depth of 24 in. were studied, and it was found that the time taken for an inch of water to pass through 3-in. layers of loose saturated soil was four hours for the first-foot sample and 12 hours for the second-foot sample. It was further found that "on a dry soil, penetration takes place rapidly to a depth of about 2 ft. because of the cracked condition of the soil near the surface. After the layer of easily penetrated soil becomes wet, it becomes so swollen and compact that it is nearly impervious, and further water movement is very slow. The fact that moisture can move only very slowly in the wet surface soil would make it necessary to run water over the soil for a very long time in order that any considerable portion might be absorbed. This is not practicable, for the experiment with a dry subsoil showed that water from the surface penetrated almost as deep in a few minutes as it did in 10 days."

The freezing point method as a new means of determining the nature of acidity and lime requirement of soils, G. J. Bouyoucos (*Michigan Sta. Tech. Bul. 27 (1916), pp. 56, figs. 18*).—The freezing point method was tested with a large number of soils of different kinds under a variety of conditions to determine their lime requirement, as well as to study the absorption by the soil of sodium, potassium, and ammonium from solutions of potassium, sodium, and ammonium hydroxids; and the effect of acids and acid salts and of soluble salts upon the lime requirement of soil.

The method as used consists of adding to 2 gm. of soil 10 cc. of water and determining the lowering of the freezing point. Then to this mixture are added various amounts of $Ca(OH)_2$ until there occurs a change in the magni-

tude or direction of the freezing point depression. The method is based upon the following principles: (1) The freezing point depression of a soil containing a soluble acid or acid salt decreases upon adding various quantities of $Ca(OH)_2$ up to a certain point and thereafter increases with further additions. This point is considered to be the point of neutralization of the acid or acid salt and of the saturation of the soil for lime. (2) The freezing point depression of a soil containing neither a soluble acid nor an acid salt but possessing an absorptive power for lime remains constant as $Ca(OH)_2$ is added up to a critical point and thereafter rises with further additions. The critical point is considered to be the saturation of the soil for lime. (3) The freezing point depression of a soil already alkaline and saturated with bases starts to rise almost immediately upon the addition of a small amount of $Ca(OH)_2$.

The results showed that the amount of lime taken up by soils varied greatly. The freezing point method gave much higher lime requirements than the Veitch method, and appeared to indicate the true maximum lime requirement of soils. "The absorption curve of the mineral soils signifies that the $Ca(OH)_2$ is taken out of solution and is rendered inactive as far as the freezing point depression is concerned. The substances which accomplish this are in the solid phase. . . . The absorption curve also indicated that there is no basic exchange in soils, when a hydrate is employed, until the soil is satisfied or saturated with the base."

Most of the few peats tested gave evidence of acidity and took up calcium, potassium, sodium, and ammonium hydroxids in equivalent amounts.

"When a soil ceased to take up one base it took up very little if any of another base, or if it did it released a corresponding amount of the one with which it was already saturated. On the other hand, when a soil still absorbed one base it absorbed a corresponding quantity of another. The addition of acids and acid salts increased the lime requirement of soils. The magnitude of the increase was approximately equal to the amount of lime required to neutralize the quantity of the acid or acid salt added. . . .

"When a soil was treated with an excess of acid and then washed, the lime requirement was also increased, but the results plotted into an absorption curve. When a soil which showed a high lime requirement was treated with an excess of acid the clear supernatant liquid failed to give an acid curve, indicating that it contained very little if any acid. The litmus paper tests showed that it was very nearly neutral. The sediment, however, gave an acid curve, signifying that it contained a considerable amount of acid. . . . When this sediment was washed with water, however, the acid curve could no longer be obtained, showing that the acid was washed away." The same was observed with salts in solution.

"All soluble salts increased the lime requirement of soils, but the magnitude of the increase was greater in the case of the neutral salts than of the acid phosphate salts."

The conclusion is drawn that "the presence of soluble acids, or acid salts, in the mineral soils under favorable natural conditions is only temporary, if ever present, and never permanent. The acidity or lime requirement of soils, therefore, seems to be due mainly to the insoluble acids of the soil, the silicic acid, silica, acid alumino-silicates, and perhaps to the insoluble organic matter. There appears to be then practically no active acidity in the mineral soils, but only negative. Exceptions to these general statements are probably very few. In the peats and mucks, however, the formation of organic acids is probably quite rapid, and consequently these soils, as indicated by the data, may contain permanent active acidity as well as permanent negative acidity."

The organic phosphorus of soil, R. S. POTTER and T. H. BENTON (*Soil Sci., 2 (1916), No. 3, pp. 291–298*).—A method proposed for determining the total organic phosphorus content of soil is described, and experiments conducted at the Iowa Experiment Station on the content of organic phosphorus in a fallow orchard soil are reported.

It was found that "while the method can not be said to give an absolute knowledge of the organic phosphorus content of soil, it at least gives comparative results. . . . As a result of the work done so far, it can be definitely stated that a large part of the phosphorus of the soil is organic in nature."

A list of 18 references to literature bearing on the subject is appended.

The effects of certain organic compounds on plant growth, M. J. FUNCHESS (*Alabama Col. Sta. Bul. 191 (1916), pp. 103–132, pls. 8*).—Two years' pot culture experiments with oats and corn are reported to determine whether the results obtained by adding fertilizers and lime and certain organic compounds, including coumarin, vanillin, pyridin, quinolin, dihydroxystearic acid, and pyrogallol, to heavy, sticky red clay, unproductive sandy soil, and to productive and unproductive sandy loam soils at rates of 100, 250, 500, and 1,000 parts per million of dry soil would parallel those obtained in solution cultures.

It was found that lime, carbon black, and pyrogallol, which have been shown to remove the toxic properties of a poor soil extract, were unable to increase the crop yield when added to the poor soils used. "On the other hand, the addition to soils of such toxic compounds as vanillin, coumarin, dyhydroxystearic acid, pyridin, or quinolin, failed to increase greatly the infertility of the infertile soils used. The application of such compounds in ratios as great as 1,000 parts per million of dry soil decreased the yields in some cases where the crop was planted on the same day that these heavy applications were made. But when these compounds had been in the soil for a few months . . . little or no toxic effects were to be found. Indeed, the nitrogenous compounds had a beneficial effect in all cases reported, though there was evidence that these may be harmful for a short time after the applications are made. This constitutes good evidence that rapid chemical or biochemical transformation of these compounds into beneficial or inert forms occurs in unsterilized soils under the conditions of these experiments. Slight injury to oats was apparent in most of the heavy treatments of pyridin and quinolin during the first weeks of growth; but this injurious action disappeared, and the pots so treated usually produced crops which compared favorably with those produced by the nitrate-treated pots."

The addition of potassium and phosphorus greatly increased the beneficial effects of pyridin and quinolin. This action is not regarded as an antitoxic action, as these two mineral elements greatly increased the effect of asparagin, nucleic acid, and sodium nitrate, none of which is toxic to plants.

It is pointed out further that "had these experiments been terminated when the plants were only 15 days old . . . both pyridin and quinolin would have been found to be harmful, while . . . vanillin and coumarin would have been recorded not injurious. Neither of the latter showed injury to oats during the first few days of growth; only in the later stages could their effect be noted, and that effect was a simple retardation of growth."

The results show "that solution culture and soil culture experiments fail to agree," and the author concludes that "soil fertility problems can not be solved by means of short-time solution culture studies."

Physiological balance of nutrient solutions for plants in sand cultures, A. G. MCCALL (*Soil Sci., 2 (1916), No. 3, pp. 207–254, pl. 1, figs. 8*).—Experiments conducted at the Maryland Experiment Station are reported on the relative growth rates of young winter wheat seedlings when grown in a substratum

of washed quartz sand, supplied with a nutrient solution having an initial total concentration of 1.75 atmospheres maximum osmotic pressure, but with 36 different proportions of potassium phosphate, calcium nitrate, and magnesium sulphate. "The total growth period was 24 days, during which time the total water loss from each culture was determined at the end of each 3-day interval. At the end of the growth period the cultures were compared with respect to (1) dry weight of tops, (2) dry weight of roots, (3) total water loss, (4) water requirement per gram of dry tops, (5) water requirement per gram of dry roots, and (6) the ratio of the weight of tops to dry weight of roots."

It was found that "the graphs representing the growth rate of young wheat plants for three preliminary series show a region of optimal growth rate lying between the concentrations 1 and 2 atmospheres. With the initial total concentration about 1.75 atmospheres, the nutrient solution that produced the greatest dry weight of tops also produced the greatest dry weight of roots. This solution is characterized by having 0.2 of the total osmotic concentration derived from KH_2PO_4, 0.7 from $Ca(NO_3)_2$, and 0.1 from $MgSO_4$.

"A general comparison of the results from this sand-culture series with solution cultures (Shive's) grown from the same lot of seed but at a different time period brings out [that] (1) the average dry weights of both tops and roots were decidedly greater for the plants grown in the sand than for those grown in the soultions; (2) the results obtained in the solution-culture series, having a total osmotic concentration of 0.1 atmosphere, are more nearly like those from the sand series than are the results secured from the more concentrated solution series (1.75 atmospheres), in which the solutions were of the same total osmotic concentration as that employed for the sand cultures; and (3) there is a marked difference between the solutions producing the best development of plants in sand and those giving the best growth in the solution cultures with respect to the osmotic proportions of the three salts employed. A comparison of the results from these two series, the one grown in solution and the other in sand cultures, furnishes evidence for the conclusion that selective adsorption plays an important rôle in bringing about the observed physiological differences. The sand-culture solutions giving low yields of tops are characterized by a wide range in the Mg/Ca ratio, a very wide range in the Mg/K ratio, and a narrow range in the Ca/K ratio value. The solutions giving high yields of tops show a narrow range in the Mg/Ca ratio and a comparatively wide range in both the Mg/K and Ca/K ratio values. The data presented support the conclusion of earlier workers to the effect that the total transpirational loss from a plant culture is approximately proportional to the growth made by the plants during the period of time considered.

"The water requirement per gram of dry tops varies considerably with the different proportions of the component salts. It appears that low water requirement for tops is associated with a low partial osmotic concentration of monopotassium phosphate, and that high water requirement is associated with high partial concentrations of both magnesium sulphate and monopotassium phosphate. The water requirement per gram of dry roots is much higher than the same value for tops. A consideration of the ratio of tops to roots brings out the fact that in every instance a high water requirement corresponds to a high ratio of tops to roots. Good growth of tops was found to be associated with a high osmotic ratio of $Ca(NO_3)_2$ to $MgSO_4$ and poor growth of tops with a low value of this ratio."

A list of 46 references to literature bearing on the subject is appended.

Preliminary investigations in comparison of field with laboratory experiments in soil biology, G. P. Koch (*Soil Sci., 2* (*1916*), *No. 1, pp. 87–92, fig. 1*).—

Preliminary investigations conducted at Rutgers College comparing field and laboratory experiments in soil biology and using loam, silt loam, and sandy soil are reported.

It was found that "biological experiments (e. g., in ammonification) can be successfully carried out in the field. As a rule, a greater amount of organic matter seems to be ammonified in the laboratory tests than in the field. Nitrogen fixation and nitrification studies in the field are greatly interfered with by rains. The nitrogen content of the soil varies considerably, even over a comparatively small area."

Sources of error in soil bacteriological analysis, H. C. Lint and D. A. Coleman (*Soil Sci., 2 (1916), No. 2, pp. 157–162, fig. 1*).—Experiments conducted at Rutgers College with sandy loam and clay loam soils, using dried blood as organic matter, to determine the influence on ammonification of time and method of mixing the soil with organic matter, are reported.

It was found that mixing the organic matter with the soil for 30 seconds showed a larger ammonia accumulation than where the mixing occupied only 15 seconds. The experimental error of the average for 30-second mixings was smaller than that obtained for 15-second mixing periods. In general, there was not so great a difference between the two periods of mixing with the shaker as was the case where the spatula was used. The averages obtained with the shaker were larger than where the spatula was used to stir the organic matter into the soil. A comparison of the moist and the air-dry soil showed a larger accumulation of ammonia in the case of the former soil. "In general, the experimental error of the averages of the soils prepared in the shaker is smaller than that obtained with the spatula, which bespeaks a narrower variation in the duplicate determinations."

A study of the action of carbon black and similar absorbing materials in soils, J. J. Skinner and J. H. Beattie (*Soil Sci., 2 (1916), No. 1, pp. 93–101, pls. 3*).—It is pointed out that finely divided carbon is a good agent for physiologically purifying distilled water and certain poor soil extracts, and that by its absorptive qualities it improves the solution as a medium for plant growth. A test made by mixing carbon black with poor soils failed to effect an improvement, as the carbon, even though it might have had an absorptive action, would itself be intermingled with the soil and be in contact with the plant roots.

"With carbon incased in porous earthenware pots buried in soil, the growth of grass, clover, and cowpeas was improved when growing in a poor unproductive soil in the greenhouse. On benches in the greenhouse a soil which contained salicylic aldehyde and other organic compounds was improved for the growth of string beans by the absorptive action of carbon buried in porous tubes in the soil. In an experiment with string beans and lettuce in greenhouse benches a soil made poor by the addition of salicylic aldehyde and vanillin was improved in productivity by the action of carbon incased in porous tubes. In a two years' field experiment carbon, charcoal, and chalk when put in porous tubes and buried in the plats caused a good increase in growth of cowpeas.

"The beneficial action of carbon and other absorbents may be attributed to its removing something from the soil solution which is harmful to plants. The soil moisture passing through the carbon in its process of moving downward and upward in the soil would be robbed of any such material. Soils which contain soluble organic substances harmful to plants would be improved for crop growth."

Five references to literature bearing on the subject are appended.

Soil fungi and their activities, S. A. Waksman (*Soil Sci., 2 (1916), No. 2, pp. 103–155, pls. 5*).—Experiments conducted at the New Jersey Experiment

Stations with garden, orchard, meadow, and forest soils, gravelly loam, a medium loam containing 48 per cent iron, an adobe soil from Oregon, and different California soils are reported to determine the numbers and activities of soil fungi.

It was found that the fungi found in all the soils studied represent a group of organisms in numbers large enough to warrant a conclusion that they probably play an important part in the fertility of the soil. No distinct difference was observed between the species of fungi found in cultivated soils and those in uncultivated soils, though each soil seemed to have a more or less characteristic fungus flora; for example, the cultivated orchard soil, has a great abundance of Mucorales, while the forest uncultivated soil, has an abundance of Penicillia and Trichodermæ. The numbers of fungi decreased rapidly with depth, so that at 12 to 20 in. below the surface very few fungi were found, the largest numbers occurring within the upper 4 in. of soil. As to the species, no distinct differences among the organisms were found with the different soil depths, except that in the subsoils of most of the soils studied, *Zygorhynchus vuilleminii* was found to be present, often as the only organism, when soil was inoculated directly upon sterile medium.

"Over 100 distinct species of fungi were isolated from the soil, belonging to 31 genera, many of the species being isolated from several of the different soils. Many pathogenic fungi, such as different Fusaria, Alternaria, Aspergilli, Coniothyrium, and others, have been isolated from the soil. . . .

"The study of the physiological activities of the fungi pointed out the fact that they do not play a very great, if any, part in the fixation of atmospheric nitrogen, but they do prove to be able to decompose organic matter rapidly and liberate ammonia, under laboratory conditions. Many of them prove to be strong decomposers of cellulose, though fewer of them hydrolize starch."

A list of 125 references to literature bearing on the subject is appended.

Azotobacter in Hawaiian soils, P. S. Burgess (*Soil Sci., 2 (1916), No. 2, pp. 183–192*).—Experiments conducted at the Hawaiian Sugar Planters' Station on the azotobacter content of 30 sugar cane soils from the islands of Oahu, Hawaii, Maui, and Kauai, as indicated by their ability to fix nitrogen in mannite solutions are reported.

Only 5 soils were noted which failed to show azotobacter growth in solutions. "In these cultures some fixation is recorded which indicates that probably certain Clostridium forms are also fairly prevalent here." Four different forms of Azotobacter were isolated in pure culture, namely, *A. chroococcum* var., *A. vinelandii* n. var.? *A. vinelandii* var., and "B 29?".

Two references to literature bearing on the subject are appended.

Environmental factors influencing the activity of soil fungi, D. A. Coleman (*Soil Sci., 2 (1916), No. 1, pp. 1–65, figs. 10*).—Experiments conducted at Rutgers College with sandy loam and clay loam soils on the influence of organic matter in the form of dried blood, cottonseed meal, soy-bean meal, vetch, and rye; of mechanical and chemical composition of the soil, moisture, and temperature on the activity of soil fungi; and experiments on the associative action of soil fungi and soil bacteria are reported. It was found that the type of soil, the quality of the organic matter, definite combinations of soil and organic matter, mechanical composition, and moisture content of soil are important factors in regulating the activities of the organisms tested.

The effect of time and depth of cultivating a wheat seed bed upon bacterial activity in the soil, P. L. Gainey (*Soil Sci., 2 (1916), No. 2, pp. 193–204, figs. 4*).—This article reports studies conducted at the Kansas Experiment Station on nitrate and ammonia formation in soil, described in a report of previous experiments by Call (E. S. R., 33, p. 217) on the effects of different methods

of preparing a seed bed for wheat on yield, soil moisture, and soil nitrates. Plats were selected which were representative of the extremes in treatment in the previous experiments.

It was found that "the differences in nitrate content reported by Call can not be attributed to a difference in the bacterial content. Some nonbiological condition existing in certain plats, under field conditions, prevents the normal activity of the bacterial flora. Among the factors controlling bacterial activity the available moisture probably plays a paramount rôle."

Four references to literature bearing on the subject are appended.

Studies on the activity of soil protozoa, G. P. Koch (*Soil Sci., 2 (1916), No. 2, pp. 163–181, fig. 1*).—In a further contribution (E. S. A., 34, p. 422) experiments conducted at Rutgers College with sandy loam and clay soil to determine the influence of moisture content, organic matter, and physical properties of soil on the presence of protozoa in soils in the active state are reported.

It was found that "the direct examination of the soil under the microscope for a period of 15 to 20 minutes (taking three or four samples), gives a fair indication as to the relative extent of active protozoa in the soil. Practically all of the protozoa as found in the soil can be observed under the low power of the microscope.

"The addition of organic matter to the Sassafras sandy loam soil encouraged a greater protozoan development than where none had been added. Additions of dried blood to the Penn clay loam soil increased the number of active protozoa but very little, while cow manure had no effect on the protozoan activity of this soil.

"Increasing the porosity and aeration of the soils by the addition of sand did not increase the number of motile protozoa.

"In the Sassafras soil to which cow manure had been added flagellates were noted on the first day, while with the other samples they were not seen until the second or third and, in some cases, the fourth day. The maximum numbers were recorded on the fourth and sixth days, after which there was a marked decrease, so that on the twenty-first and twenty-eighth days practically none were found to be in the active state. This would indicate that the destructive ability . . . would be present for only a limited period, namely, the early stages of organic decomposition.

"Flagellates were the first protozoa to excyst; later, on the third and fourth days, small ciliates appeared. On the fourteenth, twenty-first, and twenty-eighth days small ciliates were more numerous than flagellates. With these soils the largest number of protozoa was recorded where the moisture was highest. The Penn clay loam soil seemed to be a very undesirable medium for protozoa, as very few of these organisms were noted in any of the samples compared with those found in the Sassafras soil.

"At the lowest moisture content (one-third of the optimum), protozoa did not become active. With these soils moisture seemed to be the primary limiting factor which determined the presence or absence of active protozoa.

"With one exception, no correlation between the presence of protozoa in the active condition and the numbers of bacteria could be seen. Increased numbers of bacteria were observed irrespective of the presence or absence of living protozoa. On the fourteenth day in the soils, even where no protozoa were found in the active condition, there was a great decrease in bacterial numbers.

"Inasmuch as the numbers of protozoa in comparison with the bacterial numbers are so small, even in the presence of such abnormal quantities of organic matter as were used, it hardly seems that they would be of very great importance in agricultural practices."

A list of 19 references to literature bearing on the subject is appended.

The increase of nitrogen in fermenting manures, W. E. TOTTINGHAM (*Jour. Biol. Chem., 24* (*1916*), *No. 3, pp. 221–225; abs. in Chem. Abs., 10* (*1916*), *No. 14, p. 1901*).—Experiments conducted at the Wisconsin Experiment Station are reported on the increase in nitrogen content of a mixture of fresh cow and horse manure mixed in the ratio of 2:1, with and without fine and coarse chopped wheat straw at rates of 0.5 and 6.25 kg. per 6.25 kg. of manure.

After four weeks it was found that there was an appreciable gain of nitrogen in the straw-littered manures. Further tests of the manures for nitrogen fixation in mannite solution showed that "the manures contain nitrogen-fixing organisms of considerable activity. As their activity was greatest in the fermentation experiments in those manures which were mixed with straw, the latter material appears to be an important source of energy for the organisms."

The action of barnyard manure and commercial fertilizers, P. WAGNER (*Arb. Deut. Landw. Gesell., No. 279* (*1915*), *pp. 544*).—This is a report of results of a series of cooperative experiments extending from 4 to 14 years. They included 20 series of rotations varying in length from 3 to 14 years. The series were divided into two groups, one with commercial fertilizers alone and the other with the addition of manure. The soils varied from sand to clay loam. The crops grown included potatoes, beets, winter rye, winter wheat, barley, oats, and clover. The general plan and methods of conducting the experiments were substantially the same as in previous experiments reported by the author. Experimental data are given in detail and carefully summarized and analyzed.

Among the conclusions reached are that $100 expended for fertilizers produced an average increase worth $210 in the series of experiments with commercial fertilizers alone and $190 in the series in which manure and fertilizers were combined.

It was found to be necessary to apply phosphoric acid in the form of Thomas slag in great excess, namely, six to seven times as much as the increased yields contained in order to meet the crop requirements for this constituent. Only 18 per cent of the citric acid-soluble phosphoric acid in the slag applied was recovered in the crops in the course of three rotations on a soil very deficient in phosphoric acid. The assimilation of the phosphoric acid increased from year to year with continued applications of slag, reaching its normal level in about seven years. The phosphoric acid of manure was much more quickly utilized by plants than that of Thomas slag, the ratio being 100:181 in the first rotation and 100:172 in the second.

Of the potash applied in form of potash salts 34 per cent was utilized in the first rotation and 51 per cent in the course of the two rotations. The author concludes from these and previous experiments that not more than 60 per cent of the potash applied is likely to be utilized under any circumstances in practice. The potash in manure appeared to be somewhat more quickly utilized by plants than that of Stassfurt salts. For example, 34 per cent of the potash of the Stassfurt salts as compared with 40 per cent of the potash of manure was utilized in the first rotation. On the other hand, the corresponding figures for the second rotation were 51 and 52 per cent.

About 60 per cent of the nitrate nitrogen applied was utilized by the crops, but only 25 per cent of the manure nitrogen was utilized in the first rotation.

The average figures for the utilization of the fertilizing constituents of manure and commercial fertilizers by crops may be summarized in brief as follows:

Assimilation of fertilizing constituents of manure and fertilizers by crops.

	Phosphoric acid.	Potash.	Nitrogen.		Phosphoric acid.	Potash.	Nitrogen.
Sandy soils:	*Per cent.*	*Per cent.*	*Per cent.*	Loam soils:	*Per cent.*	*Per cent.*	*Per cent.*
Manure	25	58	21	Manure	25	53	19
Fertilizers	45	76	69	Fertilizers	36	70	71

The average composition of 73 samples of moderately rotted yard manure used in these experiments was phosphoric acid 0.35 per cent, potash 0.55 per cent, and nitrogen 0.5 per cent. The author holds, contrary to B. Schulze's view, that the fertilizing value of manure, as of commercial fertilizers, depends upon its percentage content of plant food (E. S. R., 26, p. 424). As with other fertilizers, however, conditions of soil and season must be favorable for the best results. Moreover, it appears that manure contains too little nitrogen to make it possible to secure the best use of the phosphoric acid and potash which it contains, crops grown with manure alone being oversupplied with the latter. Therefore the true value of the plant food of manure is not secured by its exclusive use. In no case did manure alone give as high yields as manure with fertilizers, the average relation of yields in all experiments being 1 : 1.3. Maximum crops, especially of cereals, were often obtained with fertilizers alone, and in some cases the results were higher than with fertilizers and manure combined. On the other hand, in the case of hoed crops, such as potatoes and beets, better results were uniformly obtained with fertilizer and manure combined.

The ratios of grain to straw with the different treatments were as follows:

Ratios of grain to straw with different fertilizer treatments.

Kind of crop.	Parts of grain to 100 parts straw.		
	Check.	Complete commercial fertilizer.	Complete fertilizer and manure.
Oats	63	58	55
Winter rye	52	48	48
Winter wheat	53	50	49
Barley	78	77	77

The percentage contents of phosphoric acid, potash, and nitrogen in the crops grown in the experiments are given. These show that the composition of the grain of cereals is quite constant, while that of straw and hoed crops generally is very variable. The author concludes that such data can be used only as a basis for further tests of the fertilizer requirements of plants.

The results of these experiments indicate that if sodium nitrate is used exclusively the amount applied must be increased from year to year, and, furthermore, that the exclusive use of commercial fertilizers, as a rule, accelerates the loss of nitrogen from the soil, while the use of manure with fertilizers not only prevents loss but brings about a marked increase in the nitrogen content of the soil.

Summarizing the results of 37 rotations it is shown that of 100 parts of phosphoric acid and of potash in the soil soluble in hydrochloric acid, 0.64 parts and 0.79 parts, respectively, were used by plants, and of 100 parts of total nitrogen in the soil 1.09 parts were utilized by plants.

Experiments with humogen and heated peat, C. T. GIMINGHAM (*Nat. Fruit and Cider Inst., Long Ashton [Eng.], Rpt. 1915, pp. 110–113*).—Pot experiments with tomatoes on a stiff loam soil to compare bacterized peat and heated peat, when added at rates of 1 lb. 4 oz. and 1 oz. to 20 lbs. of soil, with stable manure, stable manure and bacterized peat extract, stable manure and heated peat extract, and stable manure and sodium nitrate are reported.

It was found that large doses of both bacterized and heated peat gave large increases over the control. As good results were obtained, however, with ordinary treatment for tomato culture. "There seems no reason to attribute the increase in yield to anything more than ordinary manurial properties. . . . One oz. of humogen has apparently given as good results as 4 oz., but the increase over the yield from soil only is not very great in any case and is within the limits of experimental error. . . . The treatment with the water extract of humogen or peat has given no increase whatever."

Absorption and washing out of nitrogen in fertilizing with ammonium sulphate, C. H. VAN HARREVELD-LAKO (*Arch. Suikerindus. Nederland. Indië, 24 (1916), No. 6, pp. 177–204, fig. 1; Meded. Proefstat. Java-Suikerindus., 6 (1916), No. 2, pp. 17–44, fig. 1; abs. in Chem. Abs., 10 (1916), No. 14, p. 1902*).—The work of others bearing on the subject is briefly reviewed, and experiments are reported on the absorptive power for ammonia of Java sugar-cane soils to which 0.2-normal ammonium sulphate was added at the rate of 50 cc. per 50 gm. of dry soil.

It was found that the absorption coefficient of the soils for ammonia varied between 15 and 219 and in most cases was above 140. Soils with a high absorptive power lost less ammonia through washing than those with low absorptive power. If the absorption coefficient is between 80 and 140 there is thought to be little danger of ammonia loss by washing. As a rule a low absorption coefficient of soil accompanied a coarse texture and vice versa. There were, however, exceptions to this rule. When equal amounts of ammonium sulphate of the same concentration were added to different quantities of soil, the amount of increase in ammonia absorption decreased as the quantity of soil used increased. The presence of humus in the soil increased the absorptive power for ammonia. With reference to the exchange of ammonia for calcium, magnesium, potassium, and sodium it was found that the total sum of equivalents of the latter equaled the equivalent of the absorbed ammonia.

Phosphate rock in 1915, W. C. PHALEN (*U. S. Geol. Survey, Mineral Resources of the United States, Calendar Year 1915, pt. 2, pp. 227–244, pl. 1, fig. 1*).—This report deals with the production, sale, imports, and exports of phosphate rock during 1915, describes domestic phosphate reserves, gives notes on the conservation of phosphate rock, describes processes for making soluble phosphates, and contains an article by W. B. Hicks on simple tests for phosphate.

"The quantity of phosphate rock mined in 1915 was 1,935,341 long tons. Compared with the quantity mined in 1914 . . . this was a decrease of about 27 per cent. In Florida the decrease amounted to nearly 31 per cent; in Tennessee it was about 9 per cent; in South Carolina, 31 per cent; and in the Western States, 25 per cent. No rock was reported mined in Kentucky in 1915. Stocks on hand at the close of 1915 showed an increase for the entire country amounting to nearly 11 per cent. In Florida the increase amounted to 14 per cent; in Tennessee it was 6 per cent; in South Carolina there was a decrease of 34 per cent." "The phosphate rock marketed in the United States in 1915 amounted to 1,835,667 long tons, valued at $5,413,449. Compared with the pro-

duction of 1914 . . . this was a decrease . . . of nearly 33 per cent, and in value . . . nearly 44 per cent."

The conservation of phosphate rock in Tennessee, W. C. PHALEN (*Resources Tenn., 6 (1916), No. 4, pp. 193–216, figs. 5*).—This article deals with the occurrence and distribution of phosphate deposits in Tennessee and describes specific examples of modern ways and means of conserving phosphate rock as practiced in the Mount Pleasant, Tenn., field.

The limestones of the Canterbury Province, R. SPEIGHT (*Jour. Canterbury Agr. and Past. Assoc., 3. ser., 4 (1916), pp. 5–16, figs. 7*).—This article describes the occurrence, distribution, and composition of the limestones of the Province in New Zealand. Analyses of three different limestones from the Province show calcium carbonate contents of 88.64, 82.26, and 67.6 per cent.

Sodium chlorid as a fertilizer, P. BOLIN (*K. Landtbr. Akad. Handl. och Tidskr., 55 (1916), No. 5, pp. 368–376; Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 131 (1916), pp. 3–11; abs. in Chem. Abs., 10 (1916), No. 17, pp. 2268, 2269*).—Field experiments with sugar beets and potatoes are reported, the results of which are taken to indicate that common salt when added to the fertilizer used did not decrease the dry matter in the crop. On the other hand, it is concluded that the amount of dry matter is no less with sodium chlorid than with potassium chlorid, but is increased at about the same rate by both salts.

Fertilizer experiments with manganese dioxid used on grain, R. RICCI and G. BARBERA (*Staz. Sper. Agr. Ital., 48 (1915), No. 9, pp. 677–689; abs. in Chem. Abs., 10 (1916), No. 18, p. 2382*).—Experiments with wheat on the use of manganese dioxid alone, with sodium nitrate, and with ammonium sulphate at the rate of 300 lbs. per hectare (about 121 lbs. per acre) are reported.

The greatest yield of grain was obtained where manganese dioxid was used with sodium nitrate, and the yield with manganese dioxid alone was next. There was no apparent advantage in the use of manganese dioxid with ammonium sulphate. No great difference was observed in the yield of straw, but the manganese dioxid alone seemed to act as a depressant.

Eight references to literature bearing on the subject are appended.

How to remedy the scarcity of fertilizers, E. MIÈGE (*Comment Remédier a la Pénurie des Engrais. Paris: J. B. Baillière & Sons, 1916, pp. 59*).—This pamphlet discusses the scarcity of fertilizing materials due to the European war, and describes methods of utilizing fertilizing materials from natural sources, especially green manuring; conserving crop residues; rotation of crops, including legumes; proper cultivation; and the use of relatively cheap soil amendments.

Buying and using fertilizers, R. M. SALTER (*W. Va. Col. Agr. Ext. Dept. Circ. 87 (1916), pp. 15, figs. 7*).—This circular gives information on the purchasing and use of fertilizers, with special reference to the requirements and conditions of West Virginia soils as determined by the state experiment station.

AGRICULTURAL BOTANY.

Rolliniopsis, a new genus of Annonaceæ from Brazil, W. E. SAFFORD (*Jour. Wash. Acad. Sci., 6 (1916), No. 8, pp. 197–204, figs. 2*).—An account is given of two species of plants collected in Brazil which are considered as new forms and which, with two allied forms hitherto assigned to the genus Rollinia, are now assigned to a genus created for this purpose for which the name Rolliniopsis is proposed.

The occurrence of bacteria in frozen soil, E. C. HARDER (*Bot. Gaz., 61 (1916), No. 6, pp. 507–517, figs. 2*).—During the winter of 1914–15 the author studied the effect of cold and moisture on the number of bacteria in field and

potted soils at Madison, Wis., where the variations in temperature are said to be greater than those recorded by former investigators. The results are reported to have shown a close relation between the moisture content and the number of bacteria in the soil, also a distinct retardation caused by cold, which even a higher moisture content was usually insufficient to counteract.

Incubation studies with soil fungi, S. A. WAKSMAN and R. C. COOK (*Soil Sci., 1 (1916), No. 3, pp. 275–284, fig. 1*).—Describing studies with three fungi in order to ascertain the ways in which the lengths of the life cycles of fungi affect their relation to soil fertility, the author states that the optimum moisture conditions for ammonification by fungi lie near the physical optimum. While each organism has its own incubation period, the employment of a 12-day period is preferred as most suitable for practical work. The biological stage of the fungus seems to show correlation with ammonia accumulation. The largest amount appears during spore germination, the smallest during the time preparatory to actual spore formation. *Monilia sitophila* showed the largest accumulation within the first 3 or 4 days, a Penicillium studied between 10 and 15 days, and *Mucor plumbeus* between 6 and 10 days, these periods corresponding to those of active spore formation.

The inoculation and incubation of soil fungi, N. KOPELOFF (*Soil Sci., 1 (1916), No. 4, pp. 381–403, figs. 8*).—The author, having made a study of the accumulation of ammonia by *Rhizopus nigricans, R. oryzæ, Zygorrhyncus vuilleminii,* and *Penicillium* sp., states that an increase in the number of spores used to inoculate the soil caused a proportional increase in ammonia accumulation. One cc. of spore suspension is regarded as the most desirable quantity, all factors considered, for inoculations in experiments with pure cultures of soil fungi. To increase the number of inoculating spores beyond a certain point does not further accentuate the difference between ammonification of dried blood and that of cottonseed meal, the latter appearing to be a better source of food for the organisms employed.

With *Z. vuilleminii,* the maximum ammonia accumulation occurred on the twelfth day with both the above foods. *R. nigricans* gave its maximum with dried blood on the seventh, and with cottonseed meal on the ninth, day. A seven-day incubation period is regarded as the most advantageous, all factors considered, for a study of soil fungi other than those of the Penicillium group. After the first five days a striking increase of ammonia production is observed to occur every other day. It is thought that ammonia production depends upon the metabolic processes of the fungi rather than upon their biological stage.

On pairs of species, R. R. GATES (*Bot. Gaz., 61 (1916), No. 3, pp. 177–212, figs. 12*).—The author has begun a detailed study regarding the relationships of particular species by an examination of pairs of species in the same genus taken at random. It is considered as desirable that there should be developed a taxonomy based on the anatomical and cytological study of plants.

It has been found that the several pairs of species studied bear very different relationships to each other, both as regards characters and distribution. They may occupy identical, overlapping, adjacent, or widely separated areas. One species may be a giant of another, or may differ from it by a few sharp differences which originated as units, or may show differences which can not be externally analyzed in this way. Several such pairs are discussed with the problems they present, as well as the agency of mutation (E. S. R., 34, p. 629).

It is considered that crossing experiments and cytological investigations may provide the final answer to the specific questions involved.

Studies on the correlation of morphological and physiological characters: The development of the primordial leaves in teratological bean seedlings,

J. A. HARRIS (*Genetics, 1 (1916), No. 2, pp. 185–196*).—The author, considering a study of the relationships between slight structural variations and the physiological characteristics of individuals or of organs as one of the most fundamental lines of genetic research, has presented the results of an attempt to determine something of the more fundamental physiological characteristics to which incapacity for survival may be due. Seed of a strain of navy beans which has been under observation for several years was germinated in sand in warm houses and studied under controlled conditions as to given types of variation occurring with the greatest frequency.

The results as tabulated and discussed are considered to show that the weight of primordial leaf tissue developed by morphologically aberrant seedlings of *Phaseolus vulgaris* is, on the average, less than that produced by normal controls grown under conditions as nearly as possible comparable. Evidences obtained by employment of the conductivity and freezing point methods to detect differences in the concentration in molecules and ions in cell sap of leaves from teratological and those from normal plants suggest a lower concentration of both electrolytes and total solutes in tissue fluids of teratological plants, but the differences are slight and variable, requiring further and more refined determinations for actual demonstration of relationship. The data as a whole demonstrate merely that no clear differences in properties exist between the leaf sap of the two types of leaves.

The dependence of mutation coefficients upon external conditions, H. DE VRIES (*Ber. Deut. Bot. Gesell., 34 (1916), No. 1, pp. 2–7*).—The author details the percentages of four clear and easily recognizable mutants obtained by growing indoors at 30° C. *Œnothera lamarckiana*, also from those obtained by crossing *Œ. lata* with *Œ. lamarckiana*, *Œ. lata* with *Œ. nanella*, and *Œ. lamarckiana* with *Œ. nanella*.

A comparison of the wood structure of Œnothera stenomeres and its tetraploid mutation gigas, W. W. TUPPER and H. H. BARTLETT (*Genetics, 1 (1916), No. 2, pp. 177–184*).—Data bearing upon the nature of the changes in particular cells and tissues which follow mutative changes in the germ plasm are presented. The authors state that the change from the 2x to the 4x chromosome number in *Œ. stenomeres* is accompanied by an increase of 50 per cent in the length of the vessels and of 150 per cent in the area of the cross section, an increase of 50 per cent in the length and the diameter, and of 200 per cent in the volume of the tracheids, an increase in all three dimensions of the ray cells resulting in a cell of different shape, with an increase of 274 per cent in volume, and a breaking up of the tall multiple medullary rays into their constituent simple rays.

Anthocyanin markings and cell mutation, E. KÜSTER (*Ber. Deut. Bot. Gesell., 33 (1915), No. 10, pp. 536, 537*).—It is claimed that cell markings in many cases are to be ascribed to cell mutation, some of these, however, being independent of the formation and distribution of anthocyanin, but it is said that in a number of varieties of *Coleus hybridus* anthocyanin distribution is not to be ascribed to cell mutation.

The differentiation of starches of parent stock and hybrids, E. T. REICHERT (*Carnegie Inst. Washington Year Book, 14 (1915), pp. 408, 409*).—It is stated that the studies on the differentiation and specificity of corresponding vital substances have, during the past year, been restricted to the study of the starches of parent stocks and hybrids, noting chiefly the peculiarities observable in case of each parent and tracing them to the starch of the offspring.

The extension and improvement of methods previously employed (E. S. R., 31, p. 804) have resulted in a confirmation of the conclusions previously an-

nounced supporting the view that complex protoplasmic metabolites are specifically modified in relation to genera, species, and varieties, and hence that difference in corresponding substances constitutes a specific means of differentiation as to relationship in both plants and animals. It is stated that while the methods of investigation employed differ widely in character, the results are remarkably harmonious in the demonstration of certain principles of fundamental importance in normal and abnormal biology. Each property is claimed to be an independent physico-chemical character unit, each method and each reagent being an independent means of differentiation, so that results produced by one reagent do not indicate what will follow the employment of another. However, the property values thus determined can be reduced to figures, and when these are charted it can be seen that the sum total of these values is, in case of each starch, as distinctive of genus, species, variety, or hybrid as are ordinary botanical characters. A hybrid may be definitely referred to its true parentage, also the hybrids of separate crosses may be recognized as such. Corresponding histological examinations of plant tissue associated with macroscopical investigation have confirmed the results of the starch investigations, and strengthened the belief of the author that vital peculiarities may be resolved to a physico-chemical basis.

Notes on the anatomy of the young tuber of Ipomœa batatas, FLORENCE A. MCCORMICK (*Bot. Gaz., 61 (1916), No. 5, pp. 388–398, figs. 8*).—This is an account of a study of sweet potato in line with that of Kamerling (E. S. R., 33, p. 27) and of other authors named.

Biochemical and physiological study of the rest period in the tubers of Solanum tuberosum, C. O. APPLEMAN (*Bot. Gaz., 61 (1916), No. 4, pp. 265–294, figs. 2*).—This work has been noted from another source (E. S. R., 32, p. 129).

The vitality of seeds passed by cattle, D. MILNE (*Agr. Jour. India, 10 (1915), No. 4, pp. 353–369*).—From the experiments reported it is concluded that uncrushed wheat grains, etc., intentionally or accidentally fed to cattle working on pure culture plats during or just before seeding time are a source of serious danger to the purity of the crops.

The roots of herbaceous plants, A. P. MODESTOV (*Kornevaia Sistema Travianist'kh Rastenii. Moscow: I. N. Kushnerev, 1915, No. 1, pp. 138, pls. 3, figs. 38*).—This collection comprises four contributions. The first deals with differences in the growth attained by roots in various groups of cultivated plants, the second with the length of roots attained under conditions of natural development, and the third with the root system of flax. The fourth gives a list of related contributions, comprising over 500 titles.

Stomatal structure and function in Camellia (Thea) japonica, MAGDA HEILBRONN (*Ber. Deut. Bot. Gesell., 34 (1916), No. 1, pp. 22–31, figs. 4*).—It is claimed that in *C. japonica* the walls of the guard cells are lignified and immobile except in case of very young leaves in which the stomata can still open and close. It is stated that in three species of Thea more or less lignified stomatal cells have now been demonstrated, namely, *T. viridis*, *T. assamica*, and *T. bohea*.

The periodicity and distribution of radial growth in trees and their relation to the development of "annual" rings, J. C. GROSSENBACHER (*Trans. Wis. Acad. Sci., Arts, and Letters, 18 (1915), pt. 1, pp. 1–77*).—Certain facts observed in a study previously noted (E. S. R., 22, p. 650) have led the author to a reexamination of the extensive literature bearing upon irregularities in the time of commencement and closing of cambial activity, and a discussion is herein given of radial growth and the factors thought to determine its distribution, the author reserving for a separate paper the results obtained from a

study of the early stages of crown rot. Important hypotheses and investigations are given in some detail and compared with each other in relation to the author's observations. In the main, the present purpose of the article is to restate the questions raised by the investigators, though sometimes in modified form. A restudy of the structural and tension changes accompanying periodic growth may also, it is thought, lead to an investigation of the enzyms active during radial growth and to the effect which adverse changes of environment have upon them while in an active condition.

Winter foliation in beech, F. Weber (*Ber. Deut. Bot. Gesell., 34 (1916), No. 1, pp. 7–13, fig. 1*).—Potted young plants of *Fagus sylvatica*, after being exposed to acetylene gas for three days early in December and then brought into the hothouse, began to develop leaves by the end of the month, and during the first and second weeks of January the plants which had been exposed to the gas became covered with leaves while the controls showed no sign of awakening. The claim that a very prominent part is played by light in foliar development in winter is questioned. While the stimulating influence of light is admitted, it is thought that even the dim light of winter days may be more than sufficient to supply the light requirement as regards leaf development and that the winter rest of plants is therefore due primarily to other causes than a lack of illumination.

The action of light on the living organism, F. Schanz (*Biochem. Ztschr., 71 (1915), No. 4–5, pp. 406–414*).—This is largely a discussion of contributions made by others than the author, who, however, claims to have shown by experimentation described that chlorophyll can act as a vigorous catalyzer even on serum albumin.

The measurement of oxidation potential and its significance in the study of oxidases, G. B. Reed (*Bot. Gaz., 61 (1916), No. 6, pp. 523–527, figs. 2*).—The author describes an apparatus and a method by which, it is claimed, excellent results may be obtained, at least in some cases, in studying the effect of a catalyzer in accelerating an oxidation reaction. Some results already obtained are to be described in subsequent papers.

The significance of color changes in oxidase reagents, G. B. Reed (*Bot. Gaz., 61 (1916), No. 5, pp. 430–432*).—Quantitative values are presented as obtained in tests intended to supply workers in oxidase reactions with quantitative as well as qualitative data upon which to proceed in their investigations of this class. The oxidation necessary to produce color in ordinary oxidase reagents or in plant chromogens appears to be very small. After the color has appeared, it is thought that the oxidation may continue without further change of color. The oxidation necessary to produce color in various reagents varies over a wide range.

A comparative study of nutritive solutions, I. V. I͡akushkin (Jakouchkine) (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), 10 (1914), pp. 258–288, figs. 6; Nieskol'ko Dann'ikh po Normal'n'im Smi͡esi͡am, Moscow: Ri͡abushinskikh, 1915, pp. 32, figs. 6*).—Employing modifications as indicated of several common nutritive solutions in sand cultures, the author tested the influence exerted by each on different economic plants. These were found to respond in different ways and were modified variously by external conditions. Crone's solution, as here modified, gave improved results with millet, barley, buckwheat, and lupine. With Camelina, the solution of Pri͡anishnikov was more favorable. With flax, the solutions of Knop, Hellriegel, and Pri͡anishnikov gave better results than were obtained from Crone's solution.

The action of saline solutions on living plants in causing a reversible removal of basic substances from the plant, H. Devaux (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 15, pp. 561–563*).—In experimentation described

and discussed, it is claimed that such an aquatic plant as Elodea can be made to give up an appreciable amount of calcium to a solution of potassium chlorid or ammonium chlorid in which it is kept for 30 minutes. This decalcifying action is accompained with the fixation by the plant of a portion of the cations. Salts of other alkali metals can withdraw calcium, and the action is said to be reversible.

The relations between the presence of magnesium and assimilation in leaves, G. André (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 15, pp. 563–566*).—Having followed up the work of Willstätter (E. S. R., 24, p. 329; 30, p. 311) and Mameli (E. S. R., 35, p. 435) bearing upon the alleged relation of magnesium to chlorophyll in leaves, the author found that the absolute maximum of magnesium present in the leaves was attained in horse chestnut and lilac May 4 and May 3, respectively, and in chestnut April 26. If the ratio between organic and residual magnesium be considered, these plants attained their respective maxima May 26, May 3, and June 14.

A labile form of albumin and its relation to living protoplasm, O. Loew (*Biochem. Ztschr., 71 (1915), No. 4–5, pp. 306–320*).—It is claimed that there is present in the cell sap, and even in the cytoplasm of many plant cells, a very labile albuminous body which is differentiated from ordinary albumin in that it may be separated by means of ammonia and organic bases from the solution, after which, as a rule, it quickly undergoes a change resulting in a stable compound. This labile and active form of albumin reacts toward coloring agents as does living protoplasm, while the protosomes coagulated by heat, acids, alcohol, or other means behave like killed protoplasm in the presence of stains. The intimate relation between the stored labile albumin and the organized labile albumin or living protoplasm is said to be shown in many ways.

The organic nutriment of green flowering plants, T. Bokorny (*Biochem. Ztschr., 71 (1915), No. 4–5, pp. 321–364*).—Considerable data have been obtained by the author regarding the ability of several common plants to utilize organic products, including some such as supposedly correspond to the products of decay in humus soils.

Retention of chlorophyll in yellowed and fallen autumn leaves due to attack by animal parasites, O. Richter (*Ztschr. Pflanzenkrank., 25 (1915), No. 7, pp. 385–392, figs. 2*).—Instances of retention of green color in case of certain trees by autumn leaves in spots attacked by insects, etc., are discussed. The phenomenon may be due to an interruption of the conducting vessels or possibly to the production of certain substances by animal parasites.

Abscission in Mirabilis jalapa, F. E. Lloyd (*Bot. Gaz., 61 (1916), No. 3, pp. 213–230, pl. 1, figs. 2*).—The author concludes a study of *M. jalapa* with the claim that in this case abscission is not brought about by a separation resulting from the complete solution and destruction of a layer of tissue, but that the mode of abscission agrees in all essential details with that shown to occur in Gossypium and Aristolochia.

Abscission, F. E. Lloyd (*Ottawa Nat., 28 (1914), Nos. 3–4, pp. 41–52, figs. 3; 5–6, pp. 61–75*).—A lecture delivered before the Ottawa Field Naturalists' Club, on January 27, 1914, which includes the results of observations on about 30 species of plants with special reference to the mechanism of abscission.

Daily transpiration during the normal growth period and its correlation with the weather, L. J. Briggs and H. L. Shantz (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 4, pp. 155–212, pls. 2, figs. 18*).—An account is given of investigations on the daily transpiration of a part of the plants included in the water requirement experiments at Akron, Colo., in 1914 and 1915 (E. S. R., 34, p. 522). The principal objects of the investigations were to determine the

march of transpiration during the growth period and the extent to which the daily transpiration is correlated with various weather factors.

During a 10-day period of maximum transpiration the daily loss of water from small grains ranged from 12 to 16 times the dry weight of the crop harvested; from millets, corn, and sorghums, 6 to 9 times; and from alfalfa, 36 to 56 times. The loss of water from the small grains during the period of maximum transpiration amounted to 1.5 kg. per square meter of plant surface per day; from Sudan grass, 0.8 kg.; and from alfalfa, 1.6 per kg. These amounts are said to be from 5 to 14 per cent of the loss during the same period from a free water surface of equal area.

In considering the march of transpiration due to changes in the plant alone, transpiration in annual crop plants is found to rise to a maximum a little beyond the middle of the growth period, after which it decreases until the plants are harvested. With perennial forage crops, such as alfalfa, there is a steady increase of transpiration to a maximum at or near the time of cutting.

Correlation coefficients are shown for the different physical factors of environment as related to the transpiration of different crops. Small grains show individually a markedly higher correlation between transpiration and the intensity of the various physical factors than was observed when all the crops were combined in one population. Corn, sorghums, millets, and legumes show a somewhat lower correlation between transpiration and the intensity of the physical factors of environment. The plants of all crops show, however, the same relative dependence of transpiration on physical factors.

Self-warming in flowers of night-blooming Cereus, E. Leick (*Ber. Deut. Bot. Gesell., 34* (*1916*), *No. 1, pp. 14–22*).—Reporting results of experiments carried out in 1902 and 1904 in the botanical institute at Greifswald with *C. grandiflorus* and *C. pteranthus*, the author states that the flowers show a certain amount of self-warming, but that this does not in every case make good the loss due to transpiration and is too small to be of much biological significance. The excess temperature is related to the size of the flower and is greater when it is closed and when the humidity is high, but it shows no real periodicity and disappears at the close of the blooming period. Anthers generally develop more heat than the other floral parts.

Measurement of evaporation rates for short time intervals, E. S. Johnston and B. E. Livingston (*Plant World, 19* (*1916*), *No. 5, pp. 136–140, fig. 1*).—Noting the limitations of atmometers previously discussed (E. S. R., 34, p. 34), the authors describe herein a form of spherical porous cup atmometers in which the intensity of evaporation, which varies from time to time, may be made to indicate its value at any given time by the height of a column of mercury affected by the fluctuations in pressure.

A field auxanometer, G. N. Collins and J. H. Kempton (*Jour. Wash. Acad. Sci., 6* (*1916*), *No. 8, pp. 204–209, figs. 3*).—It is believed that the principal requirements for securing satisfactory measurements of the growth of plants in the open have been met by a contrivance which is described. The cost is said to be sufficiently low to permit a number of plants to be studied at the same time. The essential features are a pasteboard mailing tube, around which is secured the record sheet, mounted on an axis attached to the winding stem of an ordinary alarm clock lying on its face, and a marker adjustably attached to a glass rod suspended from a pulley and counterbalanced, its lower end being fastened to the top of the growing plant. The whole contrivance is inclosed in a box with glass front and attached adjustably to a vertical post driven near the plant to be studied. The advantages of the machine are described.

FIELD CROPS.

The influence of atmospheric electricity on crop development, T. Hedlund (*Ber. Verks. Alnarps Lantbr. och Mejeri Inst., 1913, pp. 67–97, fig. 1*).—Observations are reported and discussed which led to the conclusion that variations in plant development, either hereditary or otherwise, which manifest themselves in different latitudes are the result of differences in temperature and sunshine, and that there is no evidence that electric currents have any significance in this connection.

An experiment in electroculture by the Lemström system with sugar beets and grain at Alnarp is described and the data secured are shown in tables. The results were not sufficiently decisive to ascribe increases in yield to the influence of the artificially applied electric currents.

[Work with field crops on the demonstration farm at Sacaton, Arizona] (*U. S. Dept. Int., Rpt. Comr. Indian Aff., 1915, pp. 26, 27*).—Notes are given on the culture of various crops on this farm, and a yield of 890 lbs. per acre of lint of long-staple Egyptian cotton on a 4-acre plat under irrigation is reported.

Growing grain on southern Idaho dry farms, L. C. Aicher (*U. S. Dept. Agr., Farmers' Bul. 769 (1916), pp. 23, figs. 9*).—This bulletin is a discussion of the dry farming conditions of southern Idaho, based on the results obtained at the Aberdeen substation since 1911. The information given is intended in particular for those who contemplate taking up homestead claims in the Snake River basin territory. The general climatic and soil conditions are discussed. Dry farm machinery equipment is described in some detail, and recommendations are made for its use. The general cultural practices best adapted to the region are discussed, and the most productive varieties of each of the leading cereals given.

The best winter wheat varieties are those of the Crimean group of hard red winter wheats. The successful production of winter wheat is dependent upon certain climatic and topographical factors which are emphasized in the discussion. Leading spring wheat varieties are Early Baart, Pacific Bluestem, and Colorado Special. The production of this crop is also somewhat limited by conditions similar to those mentioned above. The highest-yielding oat varieties are Sixty-Day and Kherson. Winter barley has proved hardy at the lower elevations. Tennessee Winter barley has given the highest yields. Mariout and White Smyrna are the leading spring barley varieties. Winter emmer and spelt, rye, and flax have been tested at the substation, but rye is the only one of the four that can be recommended for general use. The Ivanof variety is one of the best types for this region.

Dry farm grain tests in Montana, A. Atkinson and N. C. Donaldson (*Montana Sta. Bul. 110 (1916), pp. 165–218, figs. 7*).—The work here reported has been noted from U. S. Department of Agriculture Bulletin 398 and Farmers' Bulletin 749 (E. S. R., 35, p. 735; 36, p. 33).

Measuring hay in ricks or stacks, H. B. McClure and W. J. Spillman (*U. S. Dept. Agr., Office Sec. Circ. 67 (1916), pp. 10, figs. 4*).—This circular is a revision of material noted in Bureau of Plant Industry Circular 131 (E. S. R., 29, p. 532), including new data relating to errors in measurement and to the rate of settling of hay in the stack.

A table has been compiled showing the losses due to measuring 6 in. short in any dimension for the nine different shapes of stacks illustrated. The greatest error occurs in measuring width and the least in measuring the "over."

The "Department rule," as outlined, is compared with the "quartermaster's rule" and the Frye-Bruhm rule for measuring the volume of a stack in cubic

feet. The quartermaster's rule shows a variation of 25 per cent, except when used to measure medium-full, low stacks, in which case it compares favorably with the Department rule. The Frye-Bruhm rule shows a variation of 24 per cent and compares favorably with the Department rule in the measurement of the full-rounded type of stack only.

Studies of the rate of settling indicate that hay in the stack after the third day will suffer a further loss in height of approximately 17 per cent in 146 days.

Experiments with potatoes and root crops, P. R. FEDOROV (*Bezenchuk. Selsk. Khoz. Opytn. Sta., No. 70 (1915), pp. 9*).—In culture tests with potatoes the average yield for five years was largest on ground plowed from 8 to 9 in. deep, while the average for ten years was in favor of plowing to a depth of 7 in. Experiments with tubers of different sizes for seed resulted in favor of whole tubers of large or medium size and from the use of small potatoes planted two in a hill. Planting 22 in. apart each way gave the most satisfactory results. Hoeing and hilling the soil around the plants proved beneficial except in localities subject to drought.

A comparison was made of dry manure, manure ash, ordinary barnyard manure, barnyard manure and Thomas phosphate, and Thomas phosphate used alone. The use of dry manure gave the greatest yield in 1915 and also on the average for the three preceding years.

The varieties tested, given in decreasing order of yield, were Richter Imperator, Professor Maerker, Alcohol, Six-Weeks, White Elephant, Local Yellow, White Flour Ball, Local Pink, Mayflower, White Star, Delicatesse, Sunrise, Count Razumovski, Blue Giant, and Professor Wohltmann. Richter Imperator, Professor Maerker, and Alcohol produced the greatest quantity of starch.

Beet seed was sown after soaking and the plants were thinned the middle of May and the middle of June to a distance of 17 in. in the row. The Pink half-sugar beet produced the best yield. The Gerand carrot proved most productive and resistant to insect pests.

Studies in Indian oil seeds.—I, Safflower and mustard, A. and GABRIELLE L. C. HOWARD, and A. R. KHAN (*Mem. Dept. Agr. India, Bot. Ser., 7 (1915), No. 7, pp. 235–272, pls. 6, figs. 2*).—This article discusses the economic value of Indian safflower (*Carthamus tinctorius*) and Indian mustard or rai (*Brassica juncea*), describes the blossoms of these plants, presents a classification and description of types, and reports the results of observations on pollination and cross fertilization.

Observations on the blossoms of safflower under bags and nets and unprotected led to the conclusion that insects were not necessary for pollination, provided that air movement and the natural humidity were not affected. Under parchment-paper bags the average number of seeds set per head was small as compared with blossoms covered with nets and those allowed to develop in the open. A test of confining blossoms in lamp chimneys closed below and partially opened above and allowing blossoms to develop in free air to determine the effect of increased humidity on setting showed a marked inhibiting effect of the moist, confined air in the lamp chimney, but it is thought possible that temperature is a factor also and that the pollen grains do not germinate readily in moist, hot air. The effect of the season on the setting of the seed was found to be quite marked. The best results in nearly every case were secured from early planting. A study of 321 plants of four different types resulted in the determination of 52 heterozygotes, or 16.5 per cent. In connection with this indication of a high percentage of self-fertilization it is pointed out that apparently natural crossing is not essential in maintaining the vigor of the crop.

A study of the oil content of the types of Indian safflower showed a range from 13.86 to 30.19 per cent. The data showed further that there was no

antagonism between high oil content and the full development of the red coloring matter, as indicated by the faded florets.

In selection experiments with Indian mustard, 197 out of 398 single plant cultures, or 49.5 per cent, bred true. Observations on 1,067 plants of five different types showed that only 151 were heterozygotes. The results of hybridization experiments with Indian and Burma mustard showed that in four out of six cases the F_1 was taller than the taller parent, while in the other two it was intermediate. When types with close and spreading pods were crossed the close arrangement prevailed in the progeny. Indian mustards with divided leaves crossed with Burma forms with entire leaves gave an intermediate F_1 and a series in F_2. The F_1 of a cross of late and early forms was intermediate.

Growth of legumes as influenced by lime, A. Lapaban y Layosa (*Philippine Agr. and Forester, 4 (1916), No. 9–10, pp. 181–184*).—The results are reported of liming experiments conducted at the College of Agriculture at Los Baños, caustic lime being applied at the rates of 1,500 and 2,500 lbs. per hectare. The use of lime proved beneficial for the production of psophocarpus, soy beans, and kulthi, but cowpeas and mongos gave better yields on the unlimed plats. The application of 1,500 lbs. per hectare gave the better results with psophocarpus and soy beans and the heavier application with kulthi. The effect of lime was more marked during rainy than dry weather.

Abaca fiber, R. B. Espino (*Philippine Agr. and Forester, 4 (1916), No. 9–10, pp. 200–216, fig. 1, pls. 3*).—The results of an anatomical study of abaca and of some cultural tests made with the crop are reported. The standard grades of abaca strips and of abaca fiber are briefly described.

In summarizing the article the author states that the erect stem of abaca contains no sclerenchyma strands near the epidermis, since it is enclosed and supported by many overlapping leaf sheaths strong enough to hold up the leaf laminæ, flowers, and fruit in their proper places. The width of the sheaths of a trunk is stated to increase from the outermost to one-third or one-half of the way to the middle, and decreases from there inward. The yield of fiber varies with the width of the sheath. Fibers from the edges of the sheath were determined to be stronger per unit of weight than those from the middle part of the same sheath. The strongest fiber was obtained from the widest sheath. It is stated that the most fiber strands are situated near the outer epidermis, followed on the inside by sclerenchyma strands with some conducting tissue. Large vascular bundles are found in the internal portion of the sheath. Fiber composed of cells having thin walls and wide laminæ was found weaker than fiber with cells having thicker walls and narrower laminæ, and fiber composed of long cells weaker than that composed of shorter ones.

In a field test plants exposed to the sun and wind yielded almost double the amount of fiber produced by those under shade and protected from the wind. It was found that the formation of fiber was greatly influenced by cleaning the plantation.

A study of four strains of beets, V. Bolotov (*Zhur. Opytn. Agron., 16 (1915), No. 2, pp. 106–117*).—Results of experiments are reported showing that the size of cells in beets is a hereditary character, and that beets with small cells are generally higher in sugar content than those in which the cellular structure is of larger dimensions.

Dwarf broom corns, B. E. Rothgeb (*U. S. Dept. Agr., Farmers' Bul. 768 (1916), pp. 16, figs. 7*).—This gives detailed information on the production of the dwarf broom corns. The harvesting and marketing of the crop are fully discussed.

A study of the effects of commercial fertilizers on corn, P. L. Montellano (*Philippine Agr. and Forester, 4 (1916), No. 9–10, pp. 217–230*).—The results

of a series of fertilizer experiments reported led to the conclusion that the use of reasonable amounts of double or single superphosphates is profitable on the soil in question. The crop did not appear to show any sign of preferring one form of fertilizer to another as a means of supplying the same element of plant food. Heavy applications of commercial nitrogenous fertilizers did not prove profitable. Applications of from 500 to 1,500 kg. per hectare (445 to 1,335 lbs. per acre) of lime broadcasted are considered safe and remunerative. Complete fertilizers greatly hastened the increase of height in the plants, while nitrogen alone had an invigorating effect on the development of large, deep-green leaves and heavy stalks. The use of potash seemed to affect the development of all parts of the plant.

Maize grading, 1915, J. A. T. WALTERS (*Rhodesia Agr. Jour., 13* (*1916*), *No. 1, pp. 45–51*).—The grading of maize for export in 1915 in Rhodesia is briefly reported, together with a description of the grades and the chief causes of rejection. A table shows that for a part of the year the exports consisted of 44.1 per cent of first grade and 48.7 per cent of second grade maize, while 7.2 per cent of the quantity offered was rejected.

Cotton breeding report for 1914, B. G. C. BOLLAND (*Agr. Jour. Egypt, 5* (*1915*), *No. 1–2, pp. 19–30, pls. 2*).—This is a report of progress in the breeding of four varieties of cotton, presenting detailed descriptions of the characters of each variety together with tabulated statistical data based on measurements and other determinations.

Cotton production in the United States: Crop of 1915 (*Bur. of the Census* [*U. S.*], *Cotton Prod. U. S., 1915, pp. 28*).—Statistics are presented in tables as to the cotton ginned from the crop of 1915 for the United States, the several States, and individual counties. The cotton production for the year, as reported, was 11,191,820 500-lb. bales with 880,780 500-lb. bales of linters in addition. The production of Sea Island cotton is given as 91,844 running bales.

A study of cowpea culture with special reference to selection in the New Era variety, A. CONSTANTINO Y SAN JUAN (*Philippine Agr. and Forester, 4* (*1916*), *No. 9–10, pp. 185–194*).—A selection experiment with New Era cowpeas is described and the results are discussed. Of 1,000 plants studied, 13 indicated exceptional forage and 16 exceptional grain production. As compared with unselected stock the selected plants produced a gain of 251,244 kg. of seed and 1,651,483 kg. of vegetable matter per hectare (224 and 1,470 lbs. per acre).

The New Era is reported as the one variety having proved successful on the college farm and in its vicinity at Los Baños. A test of planting cowpeas on different dates showed that the best returns were secured from plantings made from August to December.

Flax for fiber.—Its cultivation and handling, J. ADAMS (*Canada Expt. Farms Bul. 28, 2. ser.* (*1916*), *pp. 23, figs. 15*).—A general discussion is presented on the cultivation of flax for fiber and its preparation for the market under Canadian conditions. Some of the results secured in experimental work relating to flax culture at the Canada Experimental Farms are quoted.

Napier fodder or elephant grass (Pennisetum purpureum), J. A. T. WALTERS (*Rhodesia Agr. Jour., 13* (*1916*), *No. 1, pp. 87–91, pls. 4*).—A description is given of this grass and its composition is compared with that of green maize. When the crop was cut March 1, 3 ft. of green growth had been made by the first week of July as compared with 2.25 ft. when cut April 1 and 6 in. when cut May 1. Two roots of the grass planted April 17, 1914, were divided into 224 individual plants on December 7. Rooted cuttings planted on a dry ridge made a good growth, although the rainfall in the first season subsequent to planting was less than 12 in.

Methods for the determination of the hull content of oats, Zade (*Fühling's Landw. Ztg., 64 (1915), No. 11–12, pp. 295–311*).—This article reports the results of the determination of the hull content in numerous samples of several varieties of oats, describes and discusses the different steps in the determination, and proposes methods for determining this factor as a means of ascertaining the feeding value as well as to what extent the hull content represents a variety character.

For the determination of the hull content of a sample in judging its feeding value, the author proposes the removal from an average sample of all foreign matter together with all undeveloped kernels, empty hulls, hull parts, and naked caryopses, the taking of a portion of about 25 gm. from the sample thus cleaned, the separation of the hulls and the caryopses, with the removal at this time of all kernels found to be imperfect, and the determination by weight of the perfect caryopses and their hulls calculated to a percentage basis.

For the determination of the hull content as a varietal characteristic, the sample secured as above described is divided into firsts and seconds or outer and inner kernels, and the hull content determined from each separately. It is stated that for all practical purposes it is sufficient to determine the hull content for the outer kernels only, as the hull content of the outer kernel bears a fairly constant relation to that of the inner kernel. As this procedure does not take into account the relative production of the outer and inner kernels it is suggested that if this is to be ascertained the material for study should include all the kernels produced by plants representing the average stand of the field.

A study of the production of peanuts, G. Consunji y Tongco (*Philippine Agr. and Forester, 4 (1916), No. 9–10, pp. 195–199*).—Cultural notes and varietal descriptions are given, and the results of a comparison of seven varieties of peanuts are shown in tables.

The best average yields of nuts were secured from the Big Japan, Virginia Bunch, and Improved Virginia varieties. For catch crops in young plantations the American, Chinese, Big Japan, Virginia Bunch, Native Lemery, and Improved Virginia, and in old plantations the Spanish varieties; for a cover crop the Improved Virginia; for haymaking the Spanish varieties; and for marketing in the form of nuts the Chinese variety are recommended.

[Potato experiments], O. B. Whipple (*Montana Sta. Rpt. 1915, pp. 252, 253*).—Notes are given on potato experiments conducted on the station farm and at the Judith Basin substation.

At the Judith Basin substation, Pearl, Green Mountain, and Carman No. 1 gave the highest yields. Thinning slightly reduced the yield but improved the quality of the tubers. Under dry-land conditions a planting distance of from 12.5 to 15.5 in. apart in the row gave the best results, while ridging slightly reduced the yield.

On the station farm Russet Burbank gave the highest yield among the main-crop varieties, and Early Ohio the best of the early varieties. Early thinning was found to be most effective, but only with Russet Burbank was it found to increase the yield. Pure lines of Russet Burbank and Rural New Yorker, isolated by hill selection, were tested again in 1915, but did not give noticeably higher results. The planting of cull seed for a 3-year period has only slightly increased the percentage of culls produced as compared with selected seed.

Influence of the size of the seed tuber on the quantity and quality of the potato crop, P. Igonin (*Bezenchuk. Selsk. Khoz. Opytn. Sta., No. 67 (1915), pp. 5*).—The results of the experiments here reported indicated that the starch content is higher in large than in small tubers. While the size of the seed tuber influenced the growth of the plant, the increase in tuber production was not in proportion to the size of the seed tuber. The net crop from small

tubers was greater than from large ones, but the largest crop was secured from the use of medium-sized tubers for seed. The size of the seed tuber had the same influence with early and late varieties. The yield of late potatoes was from 75 to 100 per cent greater than that of early varieties.

The cost of potato production in Russia, V. Kotelnikov (*Selsk. Khoz. i Liesov., 249 (1915), Oct., pp. 213–243*).—This article reports the cost of potato production in rubles (0.515 cts.) per dessyatine (2.7 acres) for each of the Governments of Russia. The data collected in this connection are presented in tables. The average cost of production on large and small farms in 19 Governments is given in the table below:

Average cost per dessyatine of producing potatoes in 19 Governments of Russia.

Kind of expenditures.	Gentlemen's estates.		Peasants' farms.	
	Rubles.	*Per cent.*	*Rubles.*	*Per cent.*
Labor	43.24	37.2	36.66	36.3
Fertilizer	19.26	16.6	16.62	16.4
Seed	35.25	30.4	32.83	32.3
Incidentals	6.61	5.7	3.25	3.2
Land lease	11.77	10.1	11.77	11.7

Green-manuring rice, G. C. Sherrard (*Agr. Jour. Bihar and Orissa* [*India*], *3* (*1915*), *No. 1, pp. 66–68*).—The results of green-manuring rice with san hemp (*Crotolaria juncea*) and dhaincha (*Sesbania aculeata*) are reported for a series of years on three different farms.

The tabulated results show that green manuring gave an increase in the yield of rice every year at each of the places where the work was conducted. It is recommended that these green manuring crops be sown in time to reach the proper stage of development at the period when the land is ordinarily puddled, that all of the green substance of the crops be mixed with and buried in the mud, and that the rice be transplanted on the land thus prepared about a week later.

Nitrogenous fertilizers for winter rye, S. Hasund (*Tidsskr. Norske Landbr., 23* (*1916*), *No. 3, pp. 139–147*).—Cooperative experiments with Norwegian lime-nitrogen and Norwegian nitrate as a fertilizer for winter rye are described, and the results are reported in tables. The applications used furnished equal quantities of nitrogen. The use of Norwegian lime-nitrogen gave, in general, the same crop increase secured from the applications of Norwegian nitrate.

Factors influencing the protein content of soy beans, J. G. Lipman and A. W. Blair (*Soil Sci., 1* (*1916*), *No. 2, pp. 171–178*).—This is a continuation of work already noted (E. S. R., 34, p. 140).

It was found that thick seeding up to 20 and 30 plants per pot increased returns as regards dry matter and total nitrogen, the latter fact seeming to indicate increased or intensified utilization of atmospheric nitrogen by means of symbiotic bacteria in case of the thicker plantings. It seems certain that by thick seeding of soy beans, much more nitrogen is secured from a given area, much of which is drawn from the atmosphere.

In order to test whether, with abundant available nitrogen in the soil, legumes draw less nitrogen from the air than when soil nitrogen is scanty, experiments were carried out with gradually increasing nitrogenous fertilizers. From these experiments, in which both tops and roots gave the same sort of results, it is concluded that in the sand cultures at least, nodule formation is not decreased by applications of nitrogenous fertilizers. The plants evidently used some of the applied nitrogen, but the excellent growth made by the checks would lead

to the belief that perhaps 65 to 75 per cent of the nitrogen recovered was secured from the atmosphere.

Variety tests with pot cultures and in the open field are also described and discussed.

Variations in the sugar content of the beet in relation to selection in Italy, O. MUNERATI, G. MEZZADROLI, and T. V. ZAPPAROLI (*Staz. Sper. Agr. Ital., 48 (1915), No. 9, pp. 605–637, figs. 2*).—For the purpose of this study analyses of beets planted April 2, May 19, and July 11 were made on different dates from July 23 to January 5. Also different portions of the root were analyzed to determine the distribution of sugar in the beet. The data secured relating to sugar content and its fluctuation and the weight of the leaves and the roots are given in tabular form.

The results of the analysis of different portions of individual beets showed the least variation in the samples taken from the upper third of the root. From other data obtained it is concluded that the composition of the beet at a certain time can not be regarded as indicating its sugar content on an earlier or a later date, if left to grow. It was further brought out that two beets apparently identical in all respects may present different values in the transmission of their sugar-producing qualities and that, on the other hand, beets differing in weight and in sugar content may have the same merits or defects.

The influence of defoliating sugar beets on their sugar content, O. MUNERATI, G. MEZZADROLI, and T. V. ZAPPAROLI (*Staz. Sper. Agr. Ital., 48 (1915), No. 10–11, pp. 743–771, figs. 2*).—The experiments described were conducted to determine the influence of removing the leaves of sugar beets on their sugar content, and for this purpose analyses of normal and defoliated beets were made on different dates of the growing period. The results of the analyses are given in tables.

It was found that beets allowed to develop normally after transplanting increased constantly in weight in proportion to the development of the new leaves. The beets with abundant foliage were able to treble their weight in about three months, while beets with scanty foliage increased but little in weight. Beets from which the leaves were removed from time to time did not increase in weight, and in many instances showed a loss. In the normal beets the total sugar content was also closely related to the development of the leaves, while the beets defoliated sustained a loss in sugar content. The percentage of sugar also diminished constantly and progressively in the defoliated beets, while in the normal beets, with the exception of an initial reduction due to the growth of the first leaves, the percentage of sugar remained nearly stationary during the constant and progressive increase in the weight of the root. In certain individuals not only was the weight of the root greatly increased and in consequence the total sugar, but also the percentage of sugar. It was found that the defoliated beets were reduced in storage quality. The authors believe that their results confirm the claim that the production of new leaves is carried on at the expense of the sugar contained in the root.

Notes on the growth of sugar cane, J. M. TALUQDAR (*Agr. Jour. Bihar and Orissa [India], 3 (1915), No. 1, pp. 15–28, pl. 1*).—Observations are reported on the rate of growth of sugar cane, and the results of excessive growth measurements are given in tabular and graphical form.

Variation in the rate of growth noted during the season suggested that if certain canes spend more energy for their growth during a certain period they will have less energy at their disposal during the period of time immediately following, which causes a reduction in the rate of development. It is concluded from the data obtained that the rate of growth depends upon the degree of moisture and temperature of the soil and the atmosphere, that these two factors

must cooperate in their action, and that the effect of both is influenced and controlled by the individuality of the type of cane and its accumulated energy.

Chemical changes during the ripening of sugar cane, J. Mirasol y Jison (*Philippine Agr. and Forester, 4 (1915), No. 5–6, pp. 101–108*).—A study of the chemical changes occurring in ripening sugar cane is reported, and the results of experiments with local Philippine varieties are presented. The analytical data are given in tables.

It was determined that during the ripening period a point is reached when the purity is very high, the sucrose content at its maximum, and the reducing sugar at its minimum, and that sugar made from the juice at this stage is of high grade. It was observed that after this point is reached and maintained for a length of time depending on the variety, the soil, and climatic conditions, the purity and sucrose content of the cane decrease and the reducing sugar increases. The upper third of the cane was found to contain the least sucrose and the most reducing sugar, together with a low degree of purity. It is stated that the sugar produced from a given area of Los Baños White cane by a modern mill is of more than twice the value of sugar obtained from the same area by native processes.

A comparison of annual cropping, biennial cropping, and green manures on the yield of wheat, B. A. Madson (*California Sta. Bul. 270 (1916), pp. 3–14, fig. 1*).—This bulletin is an amplification of the results obtained from cereal investigations reported in Bulletin 211 (E. S. R., 24, p. 637). A study is made of the effect of continuous cropping, alternate cropping, and fallow and green manuring on the yield of wheat and on the soil.

Continuous cropping rapidly decreased the yield of wheat to a point below profitable production. Fallow was found to be the most effective means of maintaining the productiveness of semiarid soils, although the use of green manure crops increased the yield above that of continuous cropping. A decided difference was noted in the effect of different cover crops upon wheat production, the outstanding feature being that a cereal should not be used as a green manure in a cereal rotation.

The organic matter added to the soil from a green-manure crop seems to be lost through oxidation the following summer, and the humus content of the soil, or the humus nitrogen content, does not appear to be increased. The favorable effects of green-manure crops must therefore be attributed to other causes than the increase of humus in the soil. Frequent fallowing will probably deplete the humus content of the soil, although it greatly stimulates production.

The irrigation of wheat, F. S. Harris (*Utah Sta. Bul. 146 (1916), pp. 3–32, figs. 22*).—This bulletin gives the results of irrigation experiments with wheat extending over a period of four years. The general literature on the subject is reviewed, together with 17 bulletins published by the Utah Station dealing with the irrigation of wheat. The experiments were divided into two groups: (1) The plats to which varying quantities of water were added weekly, and (2) the plats receiving a uniform amount of water at each of four fixed stages in the growth of the crop. These stages were (1) when five leaves had developed, (2) when the plants were just preparing to head out, (3) when most of the plants were in bloom, and (4) the dough stage. Some of the more striking results are as follows:

The highest yields were obtained with three irrigations of 5 in. each applied at the first, second, and third stages of growth. Irrigation water applied after the grain was planted but before it was up and that applied after the dough stage decreased the yield. If only one irrigation is to be given it should be applied at the first stage of growth. The date of maturity of wheat was retarded by excessive irrigation. Economy in water was increased by the use

of barnyard manure. From 75 to 95 per cent of the yield of irrigated wheat under the various systems of irrigation was produced by the natural precipitation.

The detailed results of the experiments are given in tabular form.

Yellow-berry in wheat: Its cause as indicated by its composition, W. P. Headden (*Proc. Soc. Prom. Agr. Sci., 36 (1915), pp. 41–56*).—This paper reviews the conclusions of a number of investigators of this subject, and presents the results of experiments by the author in support of the contention (E. S. R., 33, p. 41) that the ratio of available nitrogen to available potassium, and not the climatic conditions, is the principal factor in determining flintiness and starchiness of wheat.

An experiment on wheat is noted in which 12 in. of water was applied in addition to a rainfall of 9.94 in. from spring to harvest in comparison with growing wheat with a rainfall of 8.37 in. during the same period. Under these two methods of culture both flinty and yellow-berry wheat was produced. The differences in composition of flinty and starchy kernels grown in this experiment on the same plat were found to be identical with those of the flinty and starchy kernels of the same wheats grown under the same conditions but receiving either nitrogen or potassium. It is stated that wheat grown on contiguous plats of the same land and from the same lot of seed produced dark or flinty kernels with the application of nitrates, and light-colored, starchy kernels with the application of potassium. It was further shown that the application of nitrogen suppressed the phosphorus while the application of potassium did not increase it. The samples of yellow-berry wheat analyzed in this connection contained approximately 50 per cent more phosphorus than the flinty samples.

Another experiment was made to determine the effects of applying 1, 2, and 3 acre-feet of water. Marquis wheat sown April 2 received its first and last irrigations May 11 and August 15, respectively. The plats receiving 3 acre-feet of water were irrigated at intervals of from 8 to 12 days, while the plats receiving 2 acre-feet were given five irrigations and those receiving 1 acre-foot three irrigations. The wheat produced from all these plats was badly affected by yellow-berry, but the analytical results indicated no such differences as were found between the flinty and yellow-berry wheats. A sample grown with 1 acre-foot of water contained 10.423 per cent crude protein, 7.669 per cent true gluten, and 0.45 per cent phosphorus; that grown with 2 acre-feet, 10.557 per cent crude protein, 7.381 per cent true gluten, and 0.449 per cent phosphorus; and that receiving 3 acre-feet, 10.519 per cent crude protein, 8.079 per cent true gluten, and 0.454 per cent phosphorus. A sample of wheat grown with an application of 1 acre-foot of water on another soil contained less than 15 per cent of yellow-berry and had a protein content of 15.998 per cent, of true gluten 11.042 per cent, and of phosphorus 0.374 per cent.

Three trials were made to show that well-rotted manure does not produce the results shown to follow the application of nitrogen in the form of sodic nitrate. The manure was applied at the rate of approximately 16 loads per acre and the water used was 1, 2, and 3 acre-feet. In the wheat produced on these plats yellow-berry was just as prevalent as in the grain grown without manure. The crude protein in three samples grown without manure was 10.423, 10.557, and 10.519 per cent, and in three samples grown with manure 10.813, 10.519, and 11.931 per cent. The true gluten in the grain grown without manure was 7.669, 7.381, and 8.079 per cent; with manure, 7.864, 8.005, and 7.904 per cent; while the phosphorus in the grain grown without manure was 0.45, 0.449, and 0.454 per cent, and with manure, 0.452, 0.456, and 0.458 per cent

Witch weed or rooi-bloem (Striga lutea): A new pest of the maize crop in Rhodesia, J. A. T. Walters (*Rhodesia Agr. Jour., 13 (1916), No. 2, pp. 234–236*).—This article discusses briefly the relation of this plant to maize culture and suggests a method of control. The witch weed is parasitic on the roots of the maize plant, which remains short and stunted and even fails to produce an ear when attacked. "It is computed that a single plant frequently produces a thousand seeds, and it is known that these seeds retain their germinating power for years."

Contributions to the control of weeds by means of chemical substances, especially sulphuric acid, W. Gelpke (*Beiträge zur Unkrautbekämpfung durch chemische Mittel, insbesondere durch Schwefelsäure. Diss. Univ. Giessen, 1914, pp. 74, pls. 6*).—Results of experiments in weed control by means of the following substances are described: Ferrous sulphate, iron chlorid, sulphuric acid, sodium chlorid, sodium carbonate, borax, chrome alum, potassium bichromate, manganese dioxid, acid potassium sulphate, carbolineum, carbolic acid, potash soap, calcium cyanamid, nitrate of soda, sulphate of ammonia, kainit, Thomas slag, and cupro-azotin.

For the destruction of wild mustard a 15 to 20 per cent solution of ferrous sulphate was found adequate. Other weeds, exclusive of the grasses, were destroyed by the use of sulphuric acid in solutions ranging from 3 to 10 per cent of acid of 66° Baumé. The relatively weaker solutions applied at the rate of from 1,000 to 1,500 liters per hectare (107 to 160 gal. per acre) are recommended, and applications of this kind are reported as causing no serious injury to growing grain. The use of this solution was most effective at the time the weed plants had from three to five leaves. It was found that the use of sulphuric acid solution did not destroy the underground parts of those weeds naturally provided with well-developed root systems, especially when the plants were in an advanced stage of growth.

A list of 71 references to literature on the subject is given.

HORTICULTURE.

Diseases and pests of garden plants, M. van den Broek and P. J. Schenk (*Ziekten en Beschadigingen der Tuinbouwgewassen. Groninger: J. B. Wolters, 1915, vols. 1, pp. XII+382, figs. 157; 2, pp. VIII+252, figs. 70*).—Part 1 of this work contains descriptive accounts of the destructive insects, birds, animals, and other pests of plants, as well as the more important fungus diseases. Part 2 describes the various means of combating pests and diseases of garden plants. A résumé of the principal laws enacted in various countries relating to pests and diseases of plants is included.

Muck crops, A. E. Wilkinson (*New York: Orange Judd Co., 1916, pp. XIII+257, figs. 82*).—A treatise on vegetable growing on muck land. The first few chapters discuss the nature, distribution, and value of muck and methods of reclaiming muck land. The succeeding chapters treat in detail of the culture of different vegetables, information being given relative to specific requirements, varieties, preparation of the soil, planting, care of crops, fertilizer, harvesting, marketing, yield, costs, and returns. The subject matter is drawn primarily from the experience of practical men.

[Report of horticultural investigations], O. B. Whipple (*Montana Sta. Rpt. 1915, pp. 250–252*).—In continuation of previous work (E. S. R., 33, p. 534) mulching experiments were conducted with something over 20 different vegetables. The mulch, which consisted of 5 or 6 in. of straw, proved to have a retarding influence on practically all crops, the warm season crops suffering the most. While the mulch conserved more moisture than cultivation, it lowered the

soil temperature so much as to offset the increased moisture conservation. Cauliflower was the only crop which showed any improvement, the yield and quality of heads being considerably better on mulched plats. Plants on mulched plats suffered much more from the frosts of late spring and early fall. The work is to be continued in other sections of the State where conditions are hotter and drier than at the station.

The work on premature seeding of celery was continued. Seedlings started February 2 and set in the field June 17 produced 64 per cent of seed stalks, while seedlings started March 2 and set in the field June 17 produced only 15 per cent. Soil made very rich with well-rotted manure increased the percentage of seed stalks in the case of early planting about 20, as compared with plants in good average greenhouse soil. Moving the plants of the early planting to cold frames early, where their growth was checked by cool temperatures, increased the amount of seed stalks by 30 per cent. A severe trimming of the tops at transplanting time also had a tendency to increase the number of seed stalks.

Variety tests with cabbage, cauliflower, and onions are briefly noted.

At the horticultural substation in the Bitter Root Valley apple trees in plats which have been in clover two years out of each three-year period since the orchard was planted have not only made the best growth, but have produced the most fruit. During the eight years of growth the trees on clean cultivated plats have not only produced less fruit and less growth, but are now in very bad condition due to lack of soil fertility. Most of the varieties of apples suffering the previous year from blight were again seriously affected. The Wealthy variety has shown the greatest susceptibility at the crown of the tree and just below the surface of the ground. It would appear that this variety must be worked on some resistant stock if it is to be planted commercially. Vanderpool Red gives promise of becoming a good commercial variety for such altitudes as that of the Bitter Root Valley. Of the sour cherries under test, Dyehouse and Baldwin appear to be the best early ones and Morello and Wragg the best late ones.

Tests conducted at the Judith Basin substation have demonstrated that even in the nonirrigated sections of Montana a good collection of ornamental trees and shrubs can be grown.

Notes on the newer varieties, P. THAYER (*Ohio State Hort. Soc. Ann. Rpt., 49 (1916), pp. 45–49*).—This comprises notes on the newer varieties of orchard and small fruits under observation at the Ohio Experiment Station.

Do we need new varieties of commercial fruits? E. J. WICKSON (*Trans. and Proc. Cal. Assoc. Nurserymen, 5 (1915), pp. 43–50*).—In this paper the author calls attention to some weaknesses of present varieties of commercial fruits and suggests qualities which should be sought for in producing new varieties.

Five years' experiments in orchard fertilization, F. H. BALLOU (*Ohio State Hort. Soc. Ann. Rpt., 49 (1916), pp. 94–103*).—An abridged report of investigations previously noted (E. S. R., 36, p. 40).

Pruning investigations, V. R. GARDNER, J. R. MAGNESS, and A. F. YEAGER (*Oregon Sta. Bul. 139 (1916), pp. 92, figs. 99*).—This bulletin reports the following pruning studies conducted at the station:

The early summer pruning of young apple trees, V. R. Gardner (pp. 3–45).—Preliminary experiments started by C. I. Lewis and E. J. Kraus of the station in 1910 showed that early summer pruning of young apple trees aided in the development of the framework of the trees and stimulated fruit spur formation. The present investigation was started in 1912 to find out to what extent this is the case and how the earlier bearing condition is brought about. Some of the trees in the experimental orchard received no pruning, some were pruned in the ordinary way late in the dormant season, and others were similarly

pruned during the dormant season and also given a heavy early summer (July 1 to 10) thinning out and heading back. Records of growth under the varying pruning treatments included number and length of shoots, shoot diameter, trunk circumference, and number and distribution of fruit spurs.

The results of this investigation as a whole are summarized as follows:

"The data relating to shoot growth indicate that on the average the unpruned tree increases in size a little more rapidly than the tree that is winter pruned only, or that is both winter and summer pruned. Its average annual shoot growth is less, but it loses none of this by pruning, and hence its net increase is greater. Broadly speaking, there is but little difference in increase in size between trees that are winter pruned only and those that are both winter and summer pruned. The summer-pruned trees lose more shoot growth from pruning, but they produce nearly enough more to compensate for the additional loss.

"The amount of shoot growth produced any one season by young apple trees that have not yet developed many spurs is closely correlated with the amount they made the preceding season and shows little correlation with the amount of (i. e., the severity of) their winter pruning. Likewise the amount of shoot growth produced late in the summer, following early summer pruning, is closely correlated with the amount of the shoot growth possessed by the tree at the time of summer pruning and shows little correlation with the amount of (i. e., the severity of) the summer pruning.

"During certain portions of the growing season the winter-pruned trees of certain varieties increase in trunk circumference more rapidly than trees that have been both summer and winter pruned; during other portions of the year the reverse is the case. There seems to be a close correlation between increase in trunk circumference at any period during the summer and the leaf area possessed by the tree at that particular time.

"In some varieties heavy early summer pruning has the effect of causing those shoots remaining after the pruning to thicken and become more stocky than those in trees that are not summer pruned. In other varieties the shoots in the trees that are winter pruned only are the thicker and stockier. In all the varieties studied the late shoot growth on the summer-pruned trees (i. e., the shoot growth formed after the summer pruning) is comparatively slender.

"Summer pruning of the type described affords a direct stimulus to fruit-spur formation. Some of the buds on the basal portions of the shoots that are left after the summer pruning almost invariably grow out into fruit spurs during the latter part of the summer. Those that remain dormant during the latter part of the summer are just as apt to develop into spurs the following year as similarly situated buds on shoots that are not summer pruned.

"The late summer-shoot growth of the summer-pruned trees is very productive of fruit spurs the season following its formation. A high percentage of its buds develop into spurs. Herein, apparently, lies the chief gain in fruit-spur production from the summer pruning. On the trees that are winter pruned only, there is no growth to correspond with it. There is little or no relation between the severity of the summer pruning and the number of spurs to each unit of shoot length that remains.

"Summer pruning of the type described affords a means of developing a fruit-spur system in young apple trees earlier than is possible with the ordinary method of winter pruning only; it is estimated that its judicious use with varieties bearing mainly upon spurs will enable the apple grower to bring his trees into bearing approximately a year earlier than is otherwise possible, and still maintain and develop a good framework.

"Summer-pruned trees show a tendency to mature their wood a little later in the fall and might consequently be expected to be more susceptible to winter injury. They have not, however, proved more susceptible to bark splitting caused by severe winter weather."

The influence of summer pruning on bud development in the apple, J. R. Magness (pp. 46–77).—The investigation upon which the present paper is based was conducted to determine some of the influences of certain types of summer pruning on buds of the apple. It included a study of the effect of these types of pruning upon developing flower buds on spurs, upon leaf buds borne on spurs, and upon axillary buds on the current season's growth, whether leaf or fruit. The trees included in the work were in their fourth season of growth when the first summer pruning was given them. But studies were conducted on seven representative varieties of apples, the buds being collected at different intervals during the year, prepared, stained, and mounted for further comparison. The investigation as a whole is summarized as follows:

"The method and season of spur fruit bud differentiation and development was found to be identical with that described by previous investigators. Spur leaf buds developed during early summer, but little growth occurred later than buds developed during early summer, but little growth occurred later than July in those varieties investigated.

"Axillary buds developed very rapidly for a time following their initial formation, then grew slowly until about the time shoot growth ceased. Initial differentiation of axillary fruit buds occurred about one month later than in spur buds on the same trees. The main differentiation took place during late August and September. Method of development of axillary fruit buds seemed to be exactly like that of spur fruit buds. However, they followed spur buds in point of time of differentiation, and never entirely caught up with them. The difference between axillary buds in general and buds on spurs in general seemed to be in degree of development rather than in method. No influence of the early summer heading backs could be detected in the number of fruit buds formed on established spurs. Early summer heading back tended greatly to reduce the number of fruit buds formed on the one year wood. Leaf buds on pruned shoots, both on the primary and secondary growth, were not visibly influenced by the pruning. They appeared to function like similarly located buds on unpruned shoots. This, coupled with the fact that the form of the summer-pruned shoot allows many axillary buds to be left at the time of the following winter pruning, accounts for the greatly increased number of spurs in trees that have received regularly an early summer heading back."

A bibliography of cited literature is appended and the study is illustrated by a number of microphotographic plates.

A statistical study of the fruit-spur system of certain apple trees, A. F. Yeager (pp. 78–92).—This investigation was conducted to determine what relation various characteristics of the spur bear to fruit production. Two series of data were collected. One entire series was furnished by a single 25-year-old Grimes tree. The second series was obtained for the purpose of learning something about the life histories of old spurs, and the spurs were obtained from Grimes, Domine, and Yellow Bellflower trees, all approximately 25 years old. The results secured from the data as a whole are summarized as follows:

"As a general rule, the percentage of spurs which flowered decreased more or less rapidly with age, depending on the variety. The percentage of spurs bearing fruits decreased much more rapidly than the percentage blooming. On the average, spurs decreased in amount of fruit to each bearing spur as they became older, though the more vigorous of the older spurs produced more than

the average of the younger spurs. Among spurs of uniform age, there was a marked degree of correlation between their length and production. This correlation was more pronounced as the spurs became older.

"There was considerable correlation between the amount of growth that a spur made one year and its production the following year. The average Grimes spur grew more during the year that it produced fruit, than the year it was not fruiting. Spurs bearing two years in succession averaged somewhat less to each spur the second season than other spurs that bore no crop the first season.

"There was a high degree of correlation between the diameter of spurs and their production. This was practically the same for old spurs as for young. Spurs of the same age borne on branches of large diameter bore a larger amount of fruit than those on smaller branches.

"In the Grimes tree studied the largest average production for each spur was found in the south quarter. The upper part of the tree produced more to each spur than the lower, and there was a slightly greater production for each spur on the outside of the tree than on the inside. Wherever the average production for each spur was less than the mean, the average age was more."

Factors which influence regular bearing in an apple orchard, J. H. Gourley (*Ohio State Hort. Soc. Ann. Rpt., 49 (1916), pp. 67–73*).—The substance of this paper, which is based on the results of experiments at the New Hampshire Experiment Station, has been noted from another source (E. S. R., 34, p. 833).

Arsenate of lime in combination with soluble sulphur as a spray material for the apple, G. E. Sanders (*Agr. Gaz. Canada, 3 (1916), No. 4, pp. 305–307*).—In view of the severe burning of apple leaves caused by soluble sulphur in combination with lead arsenate when used as a summer spray, tests were made of a mixture of arsenate of lime and soluble sulphur with special reference to its burning effect. Data are given showing the results of these tests, together with comparative tests of other combinations of soluble sulphur, Bordeaux, and lime-sulphur.

Briefly stated, the experiments show that a mixture of arsenate of lime, 0.75 lb. to 40 gal., and soluble sulphur, 1 lb. to 40 gal., caused practically no burning on apple foliage. It is pointed out that soluble sulphur should not be exposed to the air for any length of time, since the sodium sulphid crystals change to sodium thiosulphate or photographers' "hypo" which, even though it is more or less readily soluble in water, is incapable of any further change and therefore of no value as an insecticide or a fungicide.

Apple storage problems, L. Greene (*Trans. Ind. Hort. Soc. 1915, pp. 72–96, figs. 6*).—This paper comprises a popular summary of the author's storage investigations previously noted (E. S. R., 30, p. 41).

False blossom of the cultivated cranberry, C. L. Shear (*U. S. Dept. Agr. Bul. 444 (1916), pp. 7, pls. 4, figs. 2*).—A popular descriptive account, with illustrations, of the false blossom of cranberries which the author in his investigations of cranberries in cooperation with L. R. Jones found to be a physiological trouble due to unfavorable cultural conditions (E. S. R., 31, p. 841). To overcome the disease it is recommended that optimum conditions for growth should be provided, including good drainage, clean culture, and pruning. Where diseased vines are numerous the bog should be scalped and replanted with healthy vines. To prevent the further spread of the disease only vines known to be absolutely free from it should be planted.

The cranberry industry and its possibilities in Canada, M. B. Davis (*Canada Expt. Farms Bul. 29, 2. ser. (1916), pp. 30, figs. 20*).—This bulletin contains practical directions for cranberry culture, the subject matter being based

upon the experience of successful cranberry growers in Nova Scotia and Massachusetts.

Southern strawberries, G. M. DARROW (*Jour. Heredity, 7 (1916), No. 12, pp. 531–540, figs. 6*).—The author describes the work of prominent strawberry breeders in the South, and shows the important bearing it has had in developing the strawberry industry of the South.

Graft stocks resistant to drought, L. MALLET (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 37 (1916), No. 46, pp. 470–473*).—The results are given of a test conducted on the plains of Herault, France, in which a large number of different stocks on which were grafted the Aramon variety of grape were compared with reference to their resistance to dry conditions.

Citrus observations in Brazil, A. D. SHAMEL (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 11, pp. 396–408, fig. 1*).—A descriptive account of the agricultural expedition of the U. S. Department of Agriculture to southern Brazil in 1913–14 in quest of information relative to the navel orange and other citrus and agricultural crops of that country.

Severinia buxifolia, a citrus relative native to southern China, W. T. SWINGLE (*Jour. Wash. Acad. Sci., 6 (1916), No. 19, pp. 651–657, figs. 2*).—The species here described is a shrub readily propagated from cuttings and suitable for hedges. Experiments have shown that *S. buxifolia* can withstand unusually large amounts of salt in the soil. Hence, it is suggested that it may prove of interest as a stock for citrus fruits in regions having alkali in the soil or having salty irrigation water.

Variation in the flowers of the papaya, L. B. KULKARNI (*Poona Agr. Col. Mag., 7 (1915), No. 2, pp. 102–112, pls. 4*).—This paper has been previously noted as a reprint (E. S. R., 35, p. 449).

Notes on the history, uses, and cultivation of the papaya, H. J. DAVIES (*Dept. Land Rec. and Agr. United Prov. Agra and Oudh, Bul. 37 (1916), pp. 7*).—A popular bulletin prepared with special reference to conditions in India.

Excelsa coffee, P. J. S. CRAMER (*Teysmannia, 27 (1916), No. 4–5, pp. 211–223, pls. 2*).—The author gives an account of the present status of Excelsa coffee as grown in Java since its introduction from Africa in 1905.

Preliminary investigations of value in the selection of the tea plant, C. P. C. STUART (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Proefstat. Thee, No. 40 (1916), pp. XII+328, pls. 27, figs. 21*).—This work has been prepared with special reference to its use in the conduct of scientific and practical selection experiments with tea plants. It contains a historical and botanical study of the tea plant, methods of conducting investigations with populations and races of tea, a study of the tea blossom and tea seed, and an outline of methods for conducting selection work. A bibliography of cited literature is appended.

Report on certain aspects of the tea industry of Java and Sumatra, G. D. HOPE (*Indian Tea Assoc. [Pamphlet], 2 (1916), pp. 122, pls. 11*).—This comprises the results of a survey of the tea industry of Java and Sumatra, special attention being given to methods of work on estates that are considered to be improvements on those now employed in India.

Notes on new plants and plants not well known, W. HUNT (*Ann. Rpt. Hort. Socs. Ontario, 10 (1915), pp. 57–64, figs. 2*).—A brief review of some of the newer or less known ornamental plants that have been tested in the borders and grounds of the Ontario Agricultural College during the past five years.

Notes on novelties and plants not well known, F. E. BUCK (*Ann. Rpt. Hort. Socs. Ontario, 10 (1915), pp. 85–87*).—Descriptive notes are given on a number of the newer annual flowers being tested at the Central Farm, Ottawa.

The roses, COCHET-COCHET and S. MOTTET (*Les Rosiers. Paris: O. Doin & Sons, 1916, 4. ed., rev. and enl., pp. XIV+370, figs. 66*).—A revised and slightly enlarged edition of this work (E. S. R., 22, p. 449).

FORESTRY.

The book of forestry, F. F. MOON (*New York and London: D. Appleton & Co., 1916, pp. XVII+315, figs. 79*).—A popular treatise on forestry prepared with special reference to its use by the general reader, and particularly "Young America."

Part 1 tells the story of the forest, how it grows, how it is planted, the life of a forester, etc., the subject matter being based on methods and conditions as found in the United States. Part 2 contains popular descriptions of the more important trees and shrubs in each section of the country, including also a key for the identification of the woods of the different species. Appended to the work are tables showing the uses of the principal American species, volume table measurements for white pine, a list of reference books on forestry, and definitions of terms used in forestry and logging.

The mountain communities and the Forest Service, C. DUBOIS (*Univ. Cal. Jour. Agr., 4 (1916), No. 3, pp. 71–74, figs. 3*).—In this article the author describes some extension phases of the U. S. Forest Service employees' work among mountain communities.

Grazing resources of the National Forests, J. T. JARDINE (*Univ. Cal. Jour. Agr., 4 (1916), No. 3, pp. 79–81, figs. 3*).—An account of the extent and utilization of the grazing facilities of the National Forests.

A new method of germinating acorns for forest planting, J. W. HARSHBERGER (*Amer. Forestry, 22 (1916), No. 275, pp. 687, 688, fig. 1*).—The method here described and illustrated consists in taking immature acorns, the embryos of which have not ceased to grow, and planting them. The result is the elongation and growth of the embryo into a young seedling plant without any intervening rest period.

In view of the trouble in successfully preserving the viability of acorns over winter, it is suggested that the acorns can be planted while green in protected frames and carried over winter in the frame or cool greenhouse already germinated and ready to plant out in the spring.

Studies in tolerance of New England forest trees.—III, Discontinuous light in forests, G. P. BURNS (*Vermont Sta. Bul. 193 (1916), pp. 3–23, pls. 4*).—In continuation of previous studies of tolerance of forest trees (E. S. R., 31, p. 838), the author reviews the literature dealing with light measurements in forests and presents the results of light readings secured from a number of tree zones in Michigan and Vermont. The readings were made with special reference to determining the value of light measurements in the forest and their significance in a study of the light requirements of our forest trees. A bibliography of cited literature is appended.

Summing up the results of previous investigators relative to light quality, the author concludes that filtered light in the forest has little value as a means of decomposition of carbon dioxid; the important light in the forest is weakened white light. Data secured from readings in Michigan and Vermont forests show conclusively that the present methods of determining light values in the open forest are of little value inasmuch as the so-called shade of the forests is a discontinuous shade and a constantly changing factor. "The variations in light intensity due to clouds, the impossibility of making equal exposures in repeated readings, the variability of the forest cover thus requiring the operator to choose a typical station for the forest under consideration, and the habit of

reading only on bright days about noon; all these make for inaccuracy and emphasize the difficulty, if not impossibility, of determining the relation of forest trees to light by a study in the forests."

Since results of forest measurements indicated that the relation of tree growth to light as an influencing factor can be determined only by controlled greenhouses and nursery trials, the author constructed a series of frames, some of which were covered with white cheesecloth and others with similar cloth dyed black. With such an equipment it was found that a continuous shade of any desired percentage of total light can be obtained within certain limits during an entire experimental period. A preliminary experiment with white pine, balsam fir, and hemlock seedlings was conducted under such shade. It was found that when the light intensity was so far reduced as to register 0.0266 no starch whatever could be detected in the white pine leaves. Hemlock reached its minimum at about 0.005. The trials are being continued, using several more varieties. Observations made of white pine seedlings growing under large cheesecloth shade with the light reduced to varying degrees of intensity indicate that the chief factor of the slow development in some cases was not lack of light but some other factor, possibly root competition for water and food in the soil.

The author is of the opinion that "tolerance" should be stricken from the vocabulary of forestry students unless it can be made to mean more than light relationship, since it expresses not a light relationship but the total relationship of a tree to all factors of the habitat.

The Keene forest.—A preliminary report, J. W. Toumey and R. C. Hawley (*Yale Forest School Bul. 4 (1916), pp. 25, pls. 4*).—This comprises a descriptive account of the Keene forest of the Yale School of Forestry, located near Keene, N. H., including suggestions relative to work accomplished and to a general policy for the treatment of each type of wood in the forest.

Forests of Porto Rico; past, present, and future, and their physical and economic environment, L. S. Murphy (*U. S. Dept. Agr. Bul. 354 (1916), pp. 99, pls. 13, figs. 7*).—This bulletin comprises a report of a survey of forest problems in Porto Rico conducted by the Forest Service in cooperation with the Government of Porto Rico. It also revises and brings up to date two previous bulletins of the Forest Service dealing with the forests and forest conditions of Porto Rico (E. S. R., 11, p. 853; 16, p. 878). A general account is given of the physical and economic features of Porto Rico, together with a discussion of the condition and distribution of forests, forest formations, forest influences, commercial aspects, forest industries, products, and problems, and suggestions relative to an insular forest policy.

Appended to the bulletin is a descriptive account of Trees of Porto Rico, by W. D. Brush, L. S. Murphy, and C. D. Mell. Each species is described with reference to its nomenclature, distinguishing characteristics, wood structure, and economic uses. A bibliography of consulted literature is also appended.

The productive capacity of the Douglas fir lands, western Oregon and Washington, T. T. Munger (*Univ. Cal. Jour. Agr., 4 (1916), No. 3, pp. 92, 93, fig. 1*).—A discussion of the productive capacity of Douglas fir lands, including some data showing the current annual growth of Douglas fir forests at various ages on three separate site qualities. The discussion is based upon studies conducted under the direction of the Forest Service of the U. S. Department of Agriculture and partially noted (E. S. R., 25, p. 141).

Hevea tapping results, Experiment Station, Peradeniya, 1915, T. Petch (*Dept. Agr. Ceylon Bul. 25 (1916), pp. 14*).—A progress report on tapping experiments started in 1912 (E. S. R., 33, p. 542).

Moreh oak, a new name for Quercus morehus, W. H. Lamb (*Jour. Wash. Acad. Sci., 6 (1916), No. 19, pp. 657, 658*).—The name Moreh oak is here pro-

posed as a standard common name for *Q. morehus*, a tree of the Sierra Nevada foothills and the north coast ranges of California.

I, Timbers of British North Borneo. II, Minor forest products and jungle produce, F. W. Foxworthy (*Govt. Brit. North Borneo Dept. Forestry Bul. 1 (1916), pp. 67+VII*).—A descriptive account of the timbers of North Borneo and their uses, including also notes on minor forest products and jungle produce.

Trees in medicine, J. Foote (*Amer. Forestry, 22 (1916), No. 275, pp. 648–653, figs. 9*).—A popular account of some medicinal uses of substances obtained from trees.

Marketing of woodlot products, J. W. Calland (*Ohio Sta. Bul. 302 (1916), pp. 41–69*).—This bulletin discusses methods of measuring woodlot products, estimating the amount of timber in the woodlot, principal products and prices, cost of lumbering, determining the stumpage value of timber, uses of the principal kinds of woods and prices, and cooperative marketing.

Service tests of treated and untreated fence posts, H. Bradley (*Bul. Amer. Ry. Engin. Assoc., 18 (1916), No. 187, pp. 39–53, figs. 4; Reprint, pp. 15, figs. 4*).—In cooperation with the Forest Service of the U. S. Department of Agriculture, experimental treated and untreated fence posts were installed during the period 1906 to 1909 at the South Carolina Agricultural Experiment Station, Clemson College, S. C.; Alabama Polytechnic Institute, Auburn, Ala.; North Louisiana Agricultural Experiment Station, Calhoun, La.; University of Minnesota, Zumbra Heights, Minn.; Iowa State College, Ames, Iowa; and Maryland Agricultural College, College Park, Md. The present report briefly describes the experiments and presents the results thus far secured.

The data show that nondurable species, especially in the South, should have at least a light top treatment in addition to the heavier butt treatment. The results as a whole clearly indicate that a good open-tank treatment of fence posts with creosote will give satisfactory results in preventing decay in most of the nondurable species. Posts treated with water-gas-tar creosote and water-gas-tar have stood up very well thus far, the creosote giving somewhat better results. Brush treatments, soaking in cold oil, and double-tank treatments where asphaltum was used as the heating media in the hot bath were not very effective in preventing decay in nondurable species. Charring was apparently of no value. Care must be taken to have the butt treatment extend well above the ground line to allow for possible changes in the ground level or for carelessness in setting. The conditions seem to be more favorable for decay when posts are set around yards, pig-sties, chicken yards, barnyards, etc., than when set in fields, meadows, or woodlots.

Butternut and willow decayed so readily in the tops that a heavy treatment of the entire post seems advisable.

Analyses of several of the creosotes used in the experiments are appended.

Forest products of Canada, 1915.—Lumber, lath, and shingles (*Dept. Int. Canada, Forestry Branch Bul. 58A (1916), pp. 31*).—Statistics of the production of lumber, lath, and shingles by 3,239 mills operating in Canada during the calendar year 1915 are reported.

The total value of the lumber, lath, and shingles produced in Canada in 1915 was $69,695,477, of which lumber represented $61,919,806.

DISEASES OF PLANTS.

Pathological quarantines in 1915, R. K. Beattie (*Abs. in Phytopathology, 6 (1916), No. 1, p. 95*).—Quarantines for protection against the introduction of injurious plant diseases, in effect at the date of publication, exclude from the

United States all 5-leaved pines from Europe and Asia, on account of the white pine blister rust; potatoes from Newfoundland, St. Pierre, Miquelon, Great Britain, Germany, and Austria-Hungary, because of potato wart, and this quarantine is extended to include Canada and all continental Europe except Denmark and most of the Netherlands, on account of the powdery scab; sugar cane from all countries, on account of several serious diseases; all kinds of citrus plants from all foreign countries, because of citrus canker and other serious diseases; and corn from Java and India, because of *Sclerospora maydis*.

In addition several quarantines have been established to exclude insects.

Some interesting finds in the phytopathological inspection service for 1915, G. R. Lyman (*Abs. in Phytopathology, 6 (1916), No. 1, p. 96*).—In the inspection service in connection with the enforcement of the Federal horticultural law, there were found, during the season reported upon, citrus canker on 19 different lots of budwood from the Philippine Islands; withertip on budwood from the Philippines, Japan, Peru, Australia, and the Fiji Islands; and powdery scab on potatoes from Peru and Ireland. The Dutch bulb disease, due to *Botrytis parasitica*, was found on two shipments of bulbs grown by the Department at Bellingham, Wash. The same disease was found on tulips from Ireland and on narcissus from Holland.

Growth of parasitic fungi in concentrated solutions, L. A. Hawkins (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 5, pp. 255–260*).—The author reports an investigation to determine the possibility of the growth of fungus parasites in solutions of a considerably higher concentration than is found in the cell sap of the host plants. Ten common parasitic fungi were grown in solutions of salts and sugars of rather high concentrations, and in experiments in which fungi were grown in solutions of potassium and calcium nitrate, sucrose, and glucose, it was found that in every case the fungi grew readily in solutions in which the diffusion tensions were much higher than the total diffusion tensions of the dissolved substances in the juices of their host plants.

Culture work on the heterœcious rusts of Colorado, E. Bethel (*Abs. in Phytopathology, 6 (1916), No. 1, p. 99*).—Some of the results are briefly mentioned of culture experiments which have extended over a period of five years.

Puccinia stipæ has been grown on 9 different genera of Compositæ, *P. andropogonis* upon 8 species representing 2 genera, and *P. agropyri* upon 4 host genera. The telial stages are reported for *Æcidium ræstelioides*, *Æ. allenii*, *Æ. phaceliæ*, *Æ. onosmodii*, and *Æ. liatridis*. Interesting or new æcial hosts have been found for *Uromyces junci*, *Pucciniastrum pustulatum*, *Puccinia amphigena*, and some other species.

Rusts in the department of Sotshi, N. N. Voronikhin (Woronichin) (*Trudy Bi̋uro Prikl. Bot. (Bul. Appl. Bot.), 8 (1915), No. 6, pp. 769–807, pls. 3, figs. 5*).—The author concludes from his mycological studies during 1912 and 1913 that fungi causing rusts are widely distributed on trees and shrubs along the shores of the Black Sea and also in more elevated regions. Eleven rust-producing fungi are named, six of these being technically described as new species under the names *Antennulariella fuliginosa* (also classed as a new genus) on *Ilex aquifolium*, *Zukalia caucasica* on *Taxus baccata*, *Z. setosa* on *Prunus laurocerasus* and *Rhododendron ponticum*, *Limacinula caucasica* on *Taxus baccata*, *Chætothyrium colchicum* on *Ilex aquifolium* and *Citrus* sp., and *Triposporium tenue* on *R. ponticum* and *Staphylea colchica*.

Two wild hosts of Bacterium solanacearum, H. R. Fulton and E. E. Stanford (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 108, 109*).—The authors report having isolated *B. solanacearum* from *Ambrosia artemisiæfolia* and

Eclipta alba and on having inoculated susceptible plants with this organism. The first host species is said to be rather resistant to the organism, while the second is quite susceptible.

Life histories of Melanops, C. L. Shear and Miss A. M. Beckwith (*Abs. in Phytopathology, 6 (1916), No. 1, p. 109*).—Melanops is reported as having been found on 13 hosts and grown in pure cultures from them. Some of the cultures produced Dothiorella micropycnospores and macropycnospores. Other cultures gave a Sphæropsis of the *S. malorum* type. The taxonomic status of the organisms on the different hosts is being investigated.

Morphology and developmental conditions of Sclerotinia trifoliorum, V. Peglion (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 25 (1916), I, No. 7, pp. 521–524*).—Describing a study of the forms and behavior of *S. trifoliorum*, the author states that while the fungus extended itself readily by means of mycelial fragments, he was unable to obtain in a single case germination of the sporidia. He admits that the biological significance of these bodies is still unknown.

The perfect stage of Septoria ribis, R. E. Stone (*Abs. in Phytopathology, 6 (1916), No. 1, p. 109*).—As a result of three seasons' work, the author concludes that *Mycosphærella grossulariæ* is the perfect stage of *S. ribis*. The only previous collection of the perfect stage of the fungus in America is said to have been that reported by Pammell from Iowa (E. S. R., 3, p. 217).

Observations on the occurrence of Puccinia glumarum in the United States, H. B. Humphrey and A. G. Johnson (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 96, 97*).—This rust, which was first reported in the United States by Carleton in 1915 (E. S. R., 33, p. 744), is said to have been observed on *Triticum vulgare, T. compactum, T. durum, T. polonicum, T. spelta, Secale cereale, Hordeum vulgare, H. murinum, Elymus canadensis*, and *Bromus marginatus*. The most severe epidemic was observed at Moro, Oreg., where the grain was grown without irrigation and where the average rainfall is approximately 11 in. Certain varieties showed an estimated infection of from 70 to 90 per cent, and contrary to the results reported from Europe the varieties at Moro showing the severest infections gave the highest yields.

Biologic forms of Puccinia graminis on wild grasses and cereals, E. C. Stakman and F. J. Piemeisel (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 99, 100*).—A preliminary report is given of an investigation of the biologic forms of *P. graminis*.

P. graminis tritici is said to infect barley, wheat, *Hordeum jubatum, H. spartinum, Elymus canadensis, E. virginicus, E. robustus, Agropyron occidentale, Bromus tectorum*, and *Hystrix patula*. Rye was attacked only weakly. Other species of Agropyron have been infected in the greenhouse and rust has been observed on some of them in the field, but it is not yet known whether it occurs on them commonly.

P. graminis secalis is found to infect rye, barley, *Hordeum jubatum, H. spartinum, E. canadensis, E. virginicus, E. robustus, A. repens, A. tenerum, A. occidentale, A. caninum, A. cristatum, A. imbricatum, B. tectorum*, and *Hystrix patula*.

P. graminis avenæ was found capable of attacking oats, *Avena fatua, A. elatior, Anthoxanthum odoratum, Holcus lanatus, Phalaris canariensis, Kœleria cristata, Dactylis glomerata*, and *B. tectorum*. It weakly infects barley, *E. canadensis, Lolium italicum, L. perenne*, and *Festuca elatior*.

Attempts to change the parasitism or increase the host range of the various biologic forms by means of bridging hosts have proved unsuccessful. The biologic forms, when isolated, have so far remained sharply fixed.

Barberry and cereal rust in Denmark, J. Lind (*Tidsskr. Planteavl, 22 (1915), No. 5, pp. 767–780*).—The author states that the enactment 11 years previously of the law against barberry has resulted in the gradual decrease of the cereal rust (*Puccinia graminis*) in Denmark. In 1914 it was to be found only in weakened outbreaks, occurring late in the fall, in regions where the barberry still persists.

Puccinia on spring wheat, N. Litvinov (*Trudy Bi͡uro Prikl. Bot. (Bul. Appl. Bot.), 8 (1915), No. 6, pp. 808–815*).—Observations during 1911 to 1914 on *Triticum monococcum*, *T. dicoccum*, *T. durum*, and *T. vulgare* are said to have proved the existence of races of wheat designated as showing in some cases important differences as regards resistance to *P. glumarum* and *P. triticina*.

Further results in controlling certain barley diseases by seed treatment, A. G. Johnson (*Abs. in Phytopathology, 6 (1916), No. 1, p. 98*).—A summary is given of experiments on seed treatment of barley for control of the stripe disease (*Helminthosporium gramineum*) and loose and covered smuts (*Ustilago nuda* and *U. hordei*). Various fungicides, including copper sulphate solution, copper sulphate and salt, Bordeaux mixture, formaldehyde, corrosive sublimate, and hot water, were tested.

Practically all the treatments greatly reduced and a number eliminated the loose smut, as well as the covered smut. The stripe disease was reduced by a number of the treatments, and was entirely eliminated by formaldehyde of varying strength when the seed was soaked for three, two, and one hours at temperatures of 20, 10, and 25° C. (68, 50, and 77° F.), respectively. Aside from the formaldehyde treatment, the copper sulphate and salt mixture gave the best results.

Preliminary investigation on the deterioration of maize infected with Diplodia zeæ, P. A. van der Bijl (Byl) (*Trans. Roy. Soc. So. Africa, 4 (1915), pt. 3, pp. 231–239, figs. 2*).—From a preliminary study of maize inoculated with *D. zeæ*, the author concludes that the diseased grain has a higher acidity than healthy grain. It is stated that infected maize gives Ori's reaction distinctly, while healthy maize gives only a slight effervescence therewith. The enzym which causes the effervescence with hydrogen peroxid may be destroyed by a temperature of 60° C. (140° F.), causing failure of the test, although it is thought that it may be developed into one of considerable delicacy. At present, however, the acidity determinations appear to be more useful for practical purposes.

Preliminary notes on an heretofore unreported leaf disease of rice, G. H. Godfrey (*Abs. in Phytopathology, 6 (1916), No. 1, p. 97*).—The author reports observing early in the fall of 1914 a peculiar leaf affection of the plants in the rice fields of Louisiana and Texas. The disease somewhat resembles ordinary black rust of cereals, and an attempt has been made to produce the fruiting bodies of the organism in cultures, but without results. On cultures in agar plates, black sclerotia-like bodies were produced which seem to develop directly upon mycelia growing out of the stromatic mass in the leaf. Inoculations with fresh cultures of these sclerotia-like bodies have produced definite lesions, but it is said that they have not yet produced the appearance of general infection which occurs on the leaf in nature. The identity of the organism and the conditions under which the infection takes place remain to be determined.

Leaf smut of timothy, G. A. Osner (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 103, 104*).—A leaf smut of timothy, caused by *Ustilago striæformis*, is reported as occurring abundantly in the timothy fields of New York and northern Indiana during the past two seasons. Inoculation experiments indicate that the infection takes place only during the blossoming of the plant. Seed treatment

with formaldehyde, copper sulphate solution, and hot water gave control only in the case of hot water.

A newly noted Phyllosticta on alfalfa in America, and its ascigerous stage, F. R. JONES (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 102, 103*).—A yellow leaf blotch disease of alfalfa is reported to have been under observation for the past two years in Wisconsin, and to have been noted in Indiana, Illinois, Minnesota, South Dakota, and Iowa. The blotches are said to elongate in the direction of the veins and to become deeper in color on the older leaves. They are constantly infected with a fungus which appears to be *P. medicaginis*, and during the autumn apothecia were found which indicated that the Phyllosticta is the conidial stage of *Pyrenopeziza medicaginis*.

Some root diseases of the bean, W. H. BURKHOLDER (*Abs. in Phytopathology, 6 (1916), No. 1, p. 104*).—While engaged in an investigation of a disease of the bean in western New York, the author observed a number of fungi causing more or less trouble. Among those causing serious injury were *Fusarium* sp., *Thielavia basicola*, and in a number of cases *Rhizoctonia* sp. Inoculation experiments with the Fusarium upon crops grown in rotation with beans gave negative results. Peas, red clover, alsike clover, and alfalfa proved susceptible to *T. basicola*. The species of Fusarium appears to be distinct from any that has previously been reported on the bean.

Cabbage yellows and the relation of temperature to its occurrence, J. C. GILMAN (*Ann. Missouri Bot. Gard., 3 (1916), No. 1, pp. 25–84, pls. 2, figs. 21*).—The author concludes his report on the study of *Fusarium conglutinans*, the cause of the wilt disease called cabbage yellows, by stating that the fungus, a facultative parasite living in the soil, becomes destructive to cabbage under certain conditions, showing a somewhat high optimum temperature and a high resistance to drying both in pure culture and in the soil. Inoculation with this fungus produced the disease in a large percentage of the trials, and inoculations from diseased plants reproduced the disease, control plants remaining free from yellows. Failure of careful inoculation experiments is attributed to variations in virulence. Low temperatures (12 to 16° C. or 53.6 to 60.8° F.) prevented the development of the disease, which is favored by temperatures of 17 to 22° C.

Fourth progress report on Fusarium-resistant cabbage, L. R. JONES (*Abs. in Phytopathology, 6 (1916), No. 1, p. 102*).—In continuation of reports on the production of seed of disease-resistant cabbage (E. S. R., 33, p. 346), the author describes a selection of Brunswick which, on sick soil, gave only 18 per cent of yellows as compared with 84 per cent from commercial seed. The resistant strain produced 95 per cent of heads, while the commercial controls yielded only 76.1 per cent of heads.

Relation between storm and disease, August and September, 1915, in Texas, F. H. BLODGETT (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 100, 101*).—The author reports severe infections of anthracnose and bacterial spot of cotton following the storm that prevailed from August 16 to 19, 1915, in Texas. The area of greatest damage due to disease was located in the area of greatest storm activity, and was practically bounded by a line denoting 2 in. of rainfall during 24 hours of the storm.

Cucumber diseases in the Middle West, W. W. GILBERT (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 104, 105*).—In connection with an investigation of cucumber diseases undertaken in cooperation with the experiment stations in Indiana, Wisconsin, and Michigan, the author reports observations on a number of these diseases which are more or less widely distributed. Among them are the cucumber mosaic disease, or white pickle; scab, due to *Cladosporium cucumerinum*; anthracnose, due to *Colletotrichum lagenarium*; wilt

disease, due to *Bacillus tracheiphilus;* angular leaf spot, a new and undescribed bacterial disease; and downy mildew, due to *Peronoplasmopara cubensis.* All of these are said to be of rather general and sometimes destructive occurrence.

Angular leaf spot, a bacterial disease of cucumbers, E. Carsner (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 105, 106*).—A leaf spot disease of cucumber which has proved to be of bacterial origin is the subject of study in Wisconsin and elsewhere. The disease is characterized on the leaf by rather angular spots bounded by the larger veinlets. The spots at first have a rather water-soaked appearance, later becoming brown and often showing a ragged appearance following the breaking away of dead parts. A viscous exudate, becoming on drying a white residue, accompanies the disease, which also appears as longitudinal lesions on the stem. The disease is considered similar to that described by Burger (E. S. R., 30, p. 648). It is said to be destructive and widespread in Virginia, Wisconsin, and Michigan, occurring also in Illinois, Indiana, and Iowa. The causal organism has been isolated and its pathogenicity determined.

From preliminary experiments it is believed that the disease can be held in check by spraying with Bordeaux mixture.

Steaming of soil for the control of root rot of ginseng, J. W. Brann (*Abs. in Phytopathology, 6 (1916), No. 1, p. 101*).—Comparative tests are claimed to show that, from the standpoints of simplicity, cost of operation, and effectiveness, steaming of soil is far superior to the formaldehyde treatment for the control of the ginseng brown root rot.

The development of Mycosphærella pinodes in pure culture, R. E. Vaughan (*Abs. in Phytopathology, 6 (1916), No. 1, p. 103*).—A brief description is given of the characters of *M. pinodes* observed in connection with pea blight studies carried on at the Wisconsin Experiment Station since 1911 (E. S. R., 29, p. 645).

Spongospora subterranea and Phoma tuberosa on the Irish potato, I. E. Melhus, J. Rosenbaum, and E. S. Shultz (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 5, pp. 213–254, pls. 9, fig. 1*).—The results of a study of the geographical distribution and factors governing the occurrence of *S. subterranea* are given, together with information on the relation of the fungus to its various host plants, damage to tubers, relation to soil types, moisture, etc., and control measures.

The powdery scab is known to exist in six potato-growing sections of the United States, all northern except one which is in Florida, where potatoes are grown as a winter crop. In experiments where powdery-scab-infected seed potatoes were planted in 15 localities along the Atlantic seaboard, no infections were secured, but where soil was shipped from many localities to northern Maine and planted with infected seed, 8 out of 12 lots produced a crop showing powdery scab. Periods of damp, rainy, and cloudy weather, together with poor drainage, are said to favor the development of *S. subterranea.* Besides the potato, seven other solanaceous hosts of this fungus have been determined. The absence of the canker stage of the disease in the United States is thought to be due to the short growing period afforded the potato crop in the infected districts.

A study was made of the effect of early harvesting, seed treatment, varietal response, and soil treatment as control measures for the disease, and it was found that early harvesting is beneficial in certain seasons in Maine. Seed treatment with chemicals, especially with corrosive sublimate and formaldehyde, will reduce the disease. Certain varieties of potatoes escape infection, due rather to differences in development at the time of the infection than to disease resistance, although resistance of varieties has not been fully studied.

No soil treatment was found beneficial in eradicating the disease, though sulphur at the rate of 900 lbs. per acre reduced the amount of the disease.

Several types of dry rot were found to follow attacks of *S. subterranea.* Among these, a dry rot due to a species of Phoma is described under the name *P. tuberosa* n. sp.

The potato powdery scab quarantine, R. K. BEATTIE (*Abs. in Phytopathology, 6 (1916), No. 1, pp. 95, 96*).—An account is given of the quarantine established in 1914 because of the potato powdery scab, and it is stated that a careful survey of the potato-growing States which use Maine seed showed that the disease has established itself in only one place, this being in northeastern Florida, where a slight infection is reported. Experiments by the Bureau of Plant Industry, of the U. S. Department of Agriculture, confirm the probability that this disease would not become serious outside of the northern, cooler regions. Consequently, it was considered unnecessary to continue the quarantine, which was removed September 1, 1915.

The black leg disease of potatoes caused by Bacillus solanisaprus, P. A. MURPHY (*Canada Expt. Farms Bot. Circ. 11 (1916), pp. 8, figs. 6*).—A brief description of the symptoms and injuries due to black leg of potato, also of the life history and control of the causal organism, *B. solanisaprus*, is given. The author suggests the careful selection of seed tubers and steeping those which are to be so used for three hours in corrosive sublimate (2 oz. to 25 gal. water) or for two hours in formalin (1 pint to 30 gal. water), with careful disinfection of knives used in cutting seed tubers and the use of well-drained soil for planting.

Late blight and rot of potatoes caused by the fungus Phytophthora infestans, P. A. MURPHY (*Canada Expt. Farms Bot. Circ. 10 (1916), pp. 13, figs. 2*).—Discussing briefly the symptoms, life history, and control of *P. infestans*, the cause of late blight of potato, this circular gives directions for preparing and mixing the components of Bordeaux mixture, timely use of which has been found to be effective and profitable in this connection.

Studies in the control of storage rots of the sweet potato, J. J. TAUBENHAUS (*Abs. in Phytopathology, 6 (1916), No. 1, p. 106*).—In connection with investigations of sweet-potato diseases and their control (E. S. R., 34, p. 156), attention is called to the necessity for proper ventilation, fumigation, and the use of fungicides for the control of these diseases.

Two interesting diseases on greenhouse tomatoes, M. T. COOK and C. A. SCHWARZE (*Abs. in Phytopathology, 6 (1916), No. 1, p. 104*).—A leaf spot which is due to a fungus resembling *Ascochyta lycopersici* and a fruit rot due to *Botrytis* sp. are described as occurring on greenhouse tomatoes.

Observations on fire blight in the Yakima Valley, Washington, J. W. HOTSON (*Phytopathology, 6 (1916), No. 3, pp. 288–292, pls. 2; abs. in No. 1, pp. 115, 116*).—The author reports that in the summer of 1915 a number of unusual conditions were observed in the study of fire blight. The organism is now known to occur on cherries, to gain entrance to pear trees through leaves, to produce a red streak in the sapwood of some varieties of pears, to infect the Yakimine (a cross between a prune and a peach), and to produce an abnormal amount of fruit infection. The fruit infection in some cases was traced to injuries produced in thinning apples.

Black rot, leaf spot, and canker of pomaceous fruits, L. R. HESLER (*New York Cornell Sta. Bul. 379 (1916), pp. 51–148, pls. 8, figs. 20*).—The results are given of an extensive study of the black rot, leaf spot, and canker of pomaceous fruits. A study was made of the host plants, varietal susceptibility, history of the disease, etc., and notes are given on its geographic distribution and economic importance. The symptoms of disease on the different parts of the

host plant are described, together with the results of a study in the morphology, physiology, and pathogenicity of the fungus. Life history studies and control measures are given. The author has tentatively adopted the name *Physalospora cydoniæ* for the causal organism, thus following Arnaud (E. S. R., 27, p. 747). Attention is called to the discovery by Potebnia that the black-rot fungus is parasitized in its Macrophoma stage by *Helicomyces sphæropsidis*.

An extensive bibliography is given.

Treatment for anthracnose (*Vie Agr. et Rurale, 6 (1916), No. 9, p. 155, fig. 1*).—A communication from Lafforgue, at Gironde, states that anthracnose, which in years of heavy precipitation and high soil moisture attains much importance, is more advantageously treated during the winter. The treatment to be applied after a heavy frost contains 40 to 50 kg. iron sulphate, 1 liter sulphuric acid, and 100 kg. water. Another consists of 10 liters sulphuric acid in 100 liters water. After the vines are in leaf good results are obtained from the use of lime-sulphur.

A wilt disease of the columbine, J. J. TAUBENHAUS (*Phytopathology, 6 (1916), No. 3, pp. 254–257, figs. 2; abs. in No. 1, pp. 101, 102*).—A serious wilt disease of columbine is reported as occurring at the Delaware Experiment Station in 1913. A fungus which has been identified as *Sclerotinia libertiana* attacks the crown and then the stem, causing a gradual wilting and drying of the plant. The organism has been isolated and the disease reproduced artificially in the greenhouse. The sclerotia are said to be present in large numbers in the dead plants in which the fungus winters over in the usual way.

Sclerosis of Forsythia viridissima, V. PEGLION (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 25 (1916), I, No. 9, pp. 655–657*).—The author reports having observed since 1915 in the garden of the agricultural school at Bologna a disease of the flower stalks of *F. viridissima* which is thought to be due to the presence of *Sclerotinia libertiana*.

A new disease of bamboo, M. TURCONI (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 25 (1916), I, No. 7, pp. 528–532*).—The author describes a serious disease observed on the branches of *Bambusa mitis* in the botanical garden of Pavia in 1914. A fungus associated therewith is regarded as a new species, the conidial form being technically described as *Melanconium bambusæ* and the ascosporous stage as *Scirrhia bambusæ*.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A bibliography of British ornithology from the earliest times to the end of 1912, W. H. MULLENS and H. K. SWANN (*London: Macmillan & Co., Ltd., 1916, pt. 1, pp. 112*).—Brief biographical sketches are given of British ornithologists, followed by lists of their published works.

Notes on Indiana earthworms, H. V. HEIMBURGER (*Proc. Ind. Acad. Sci., 1914, pp. 281–285*).—A list is given of 14 species observed in Indiana, with notes on their habits.

A review of applied entomology in the British Empire, C. G. HEWITT (*Ann. Ent. Soc. Amer., 9 (1916), No. 1, pp. 1–34*).—This is the annual address of the president of the Entomological Society of America, delivered at Columbus, Ohio, on December 29, 1915, in which he deals with economic entomology in the British Isles, Africa, Australia, Canada, Ceylon, Fiji, India, New Zealand, and the British West Indies.

How gases enter insects, W. MOORE (*Ann. Ent. Soc. Amer., 9 (1916), No. 2, pp. 224–226, figs. 4*).—From the experiments conducted the author concludes that gases can penetrate through other parts of the body than the spiracles.

A method of keeping alcoholic specimens, F. C. Bishopp (*Ann. Ent. Soc. Amer., 9 (1916), No. 1, pp. 94–96, fig. 1*).

A new insecticide, L. Smith (*Rpt. Agr. Expt. Sta. St. Croix, 1914–15, p. 30*).—A stock solution consisting of 4.5 lbs. whale-oil soap dissolved in 1,000 cc. of fusel oil, to which 8,000 cc. of kerosene is then added, has been found to meet the requirements of a kerosene emulsion that will keep for a long time, both in concentrated and diluted forms, without the separation of the kerosene.

Notes on some miscellaneous economic insects found in New Jersey, H. B. Weiss (*Canad. Ent., 48 (1916), No. 4, pp. 141–143*).—Notes are given on the occurrence of several insect pests in New Jersey, including *Hemichionaspis aspidistræ*, which is a serious pest in many fern houses; *Isosoma orchidearum*, known as the Cattleya fly, an important pest in practically all orchid houses in the State where Cattleya species are grown, etc.

Report of the entomologist, G. N. Wolcott (*Rpt. Bd. Comrs. Agr. P. R., 4 (1915), pp. 17–22*).—A brief statement of the work of the year, including summaries of Bulletins 11, 12, and 14, by T. H. Jones, previously noted (E. S. R., 33, pp. 452, 453, 458).

Insect pests of the year, J. R. Bovell (*Rpt. Dept. Agr. Barbados, 1914–15, pp. 38–43*).—This report of the occurrence and work of the year with the more important insect pests includes a revised list of the Coccidæ of Barbados, 59 in number.

Report of the economic biologist, G. E. Bodkin (*Rpt. Dept. Sci. and Agr. Brit. Guiana, 1914–15, App. 3, pp. 11*).—This report of the occurrence of and work with insect pests in British Guiana during the year includes lists of eight species of thrips of economic importance of which two are new to science, identified by J. D. Hood of the U. S. Department of Agriculture; and a list of Aleyrodidæ of British Guiana, identifications of several of which have been made by A. L. Quaintance, likewise of this Department. A number of hymenopterous parasites reared from various hosts of economic importance are also listed.

[Reports of] division of entomology, F. P. Jepson (*Fiji Dept. Agr. Ann. Rpts. 1914, pp. 17–27; 1915, pp. 16–22*).—These report the occurrence of and work with the more important insects in Fiji during 1914 and 1915.

Insect and arachnid pests of 1915, R. S. MacDougal (*Trans. Highland and Agr. Soc. Scot., 5. ser., 28 (1916), pp. 107–139, figs. 14*).—This is the usual annual report of observations of the occurrence and biology of the more important insect pests of the year (E. S. R., 34, p. 652).

Sarcosporidia, G. van de Wall de Kock (*So. African Jour. Sci., 12 (1916), No. 6, pp. 200–212*).—A summary of the present status of knowledge of these protozoan parasites.

Grasshopper control in relation to cereal and forage crops, W. R. Walton (*U. S. Dept. Agr., Farmers' Bul. 747 (1916), pp. 18, figs. 21*).—A popular summary of information relating to grasshoppers and their control.

Some northern Georgia Acridiidæ, H. A. Allard (*Canad. Ent., 48 (1916), No. 8, pp. 274–279*).

Notes on Orthoptera and orthopteran habitats in the vicinity of La Fayette, Indiana, H. Fox (*Proc. Ind. Acad. Sci., 1914, pp. 287–321*).

Parthenogenesis in Anthothrips verbasci, A. F. Shull (*Rpt. Mich. Acad. Sci., 16 (1914), pp. 46–48*).—The author reports experiments which show that *A. verbasci* was reproduced parthenogenetically. It is pointed out that the discovery of parthenogenesis in this species, a form which gives more evidence of sexual reproduction in nature than almost any species in the region around Ann Arbor, greatly reduces the probability that sexual reproduction is of common occurrence in Thysanoptera as a group.

Descriptions of new Thysanoptera, J. D. Hood (*Proc. Biol. Soc. Wash., 29 (1916), pp. 109–123, pl. 1*).—Of the 11 species here described as new 8 are from the United States.

Feeding habits of Sinea diadema, H. L. Parker (*Ent. News, 27 (1916), No. 6, pp. 280, 281*).—Through its increasing abundance in the fields in summer and its predacious habit this reduviid has become of economic importance.

The potato tingid (Recaredus sp.), H. L. Dutt (*Agr. Jour. Bihar and Orissa [India], 2 (1914), Double No., pp. 36–47*).—This pest was first noticed about four years ago attacking stored potatoes in cellars at Tunia in the Champaran district. It does serious damage in the affected locality by sucking out the sap and converting the tubers into mere hard lumps which can not be used for either eating or seed purposes. Systematic, biologic, and economic data relating to it are presented.

Monograph of the North American species of Orthotylus (Hemiptera), E. P. Van Duzee (*Proc. Cal. Acad. Sci., 4. ser., 6 (1916), No. 5, pp. 87–128, fig. 1*).—Thirty-four species of this genus of capsids recorded from North America are described, of which 24 are new.

The Anoplura and Mallophaga of North American mammals, V. L. Kellogg and G. F. Ferris (*Leland Stanford Jr. Univ. Pubs., Univ. Ser., 1915, pp. 74, pls. 8, figs. 18*).—The first part of this work deals with the Anoplura. A key to the families, subfamilies, and genera is followed by descriptions of new species and determinations of old species of Anoplura, the authors having had at hand 22 species and 2 varieties, 8 species and both varieties being described as new. The second part of the work presents descriptions of new species and determinations of old species of Mallophaga, of which the authors had at hand 18 species, one of which is new. A mammalian host list of North American Anoplura and Mallophaga is included.

A catalogue and host list of the Anoplura, G. F. Ferris (*Proc. Cal. Acad. Sci., 4. ser., 6 (1916), No. 6, pp. 129–213*).—A synonymic catalogue of the Anoplura (pp. 135–185) is followed by a systematic host list (pp. 186–204).

Eighty-seven generations in a parthenogenetic pure line of Aphis avenæ, H. E. Ewing (*Biol. Bul., 31 (1916), No. 2, pp. 53–112, figs. 19*).—A detailed report of breeding investigations. The occurrence of pedogenesis is recorded, and the effect of continued parthenogenetic reproduction on virility and metabolism of a strain has been determined. The effects of temperature on growth, size, reproduction, and dimorphism are also noted.

A review of the Pterocommini, A. C. Baker (*Canad. Ent., 48 (1916), No. 8, pp. 280–289*).

Aphididæ found on the apple in Britain and the description of a new species from Africa, F. V. Theobald (*Canad. Ent., 48 (1916), Nos. 5, pp. 169–177; 6, pp. 202–213, figs. 5; 7, pp. 233–242; 8, pp. 261–263, fig. 1*).—Eight species of plant lice have been found at different times on the apple in Great Britain, namely, *Aphis pomi, A. kochii, Siphocoryne avenæ, Erisoma lanigera, A. cratægi, A. rumicis, Phorodon humuli,* and *A. nigra* (*oxyacanthæ*), the first four of which are common. *Aphis pomonella* on the apple at Nairobi, British East Africa, is described as new to science.

A satisfactory method of rearing mealy bugs for use in parasite work, E. J. Branigan (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 8, pp. 304–306, figs. 2*).—Considerable success has been met with in the rearing of mealy bugs on potato sprouts, use having already been made of them in transporting enemies of mealy bugs from Japan to California.

A new fungus on the green scale, W. Nowell (*Agr. News [Barbados], 15 (1916), No. 375, p. 302*).—The green scale (*Lecanium viride* [*Coccus viridis*])

on lime twigs has been found infested by a hitherto unrecorded and as yet undescribed fungus that is related to *Empusa fresenii*.

The common cabbage worm (Pontia rapæ), F. H. Chittenden (*U. S. Dept. Agr., Farmers' Bul. 766 (1916), pp. 14, figs. 10*).—This replaces Circular 60 of the Bureau of Entomology, previously noted (E. S. R., 17, p. 162).

The fall army worm, or "grass worm," and its control, W. R. Walton and P. Luginbill (*U. S. Dept. Agr., Farmers' Bul. 752 (1916), pp. 16, figs. 13*).—A summary of information prepared with the intention of supplying the farmer and others with the necessary information concerning the life history of *Laphygma frugiperda* and its control.

The campaign against surface caterpillar at Mokameh in 1913, E. J. Woodhouse and H. L. Dutt (*Agr. Jour. Bihar and Orissa [India], 2 (1914), Double No., pp. 16–35, pls. 4*).—This fourth report (E. S. R., 32, p. 58) records the work of the year 1913 with *Agrotis ypsilon*.

The campaign against surface caterpillar at Mokameh in 1914–15, H. L. Dutt (*Agr. Jour. Bihar and Orissa [India], 3 (1915), No. 1, pp. 1–14, pls. 3*).—This fifth report on *Agrotis ypsilon* deals with trapping work.

On the taxonomic value of some larval characters in the Lepidoptera, C. Heinrich (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, pp. 154–164, figs. 4*).

The apple leaf-sewer, B. R. Leach (*U. S. Dept. Agr. Bul. 435 (1916), pp. 14, pl. 1, figs. 6*).—The apple leaf-sewer (*Ancylis nubeculana*), generally distributed over the North and Central Atlantic States, the Middle West, and in portions of Canada, when present in sufficient numbers may cause serious injury to apple foliage.

The eggs are deposited singly or in irregular groups, usually on the underside of the leaf and hatch at Winchester, Va., during June in about 8.8 days. The newly-hatched larva spends the first three or four weeks of its life under a silken covering on the underside of the leaf, the remainder of the larval feeding period of 125 to 141 days being passed within a succession of folded leaves, which it destroys by eating the upper parenchyma. It hibernates as a larva upon the ground within the fallen leaf and while in this state is able to withstand wide extremes of moisture and temperature.

"In the latitude of northern Virginia, in a normal season, pupation begins about April 20, or possibly a little before, depending on the relative lateness of the season. The larva pupates within the folded leaf upon the ground. The average pupal period of the wintering larva of the apple leaf-sewer at Winchester, Va., in 1915, was 26.05 days. In 1915 the moths continued to emerge from May 7 to June 8. They began to deposit eggs upon the apple foliage in from one to two days after emergence. Oviposition lasted from 5 to 13 days, and the moths averaged 65 eggs each. They lived from 5 to 18 days, averaging 10.3 days. The moths are active during the day, especially during the morning, at which time they appear to deposit most of their eggs.

"The principal insect enemy of the apple leaf-sewer in Virginia appears to be *Pseudomphale ancylæ* n. sp., of the family Chalcididæ. At all times during the larval stage the apple leaf-sewer is very susceptible to arsenical sprays. Arsenate of lead should be used at the rate of 2 lbs. to 50 gal. of water. Bearing orchards receiving the customary spraying for the codling moth usually escape injury from the apple leaf-sewer. Young orchards should receive an arsenical spray as soon as the insect appears in numbers sufficient to cause serious damage."

A list of 13 references to the literature is appended.

Descriptions of new North American Microlepidoptera, A. Busck (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, pp. 147–154*).

Tertian malarial fever.—Transmission experiments with Anopheles punctipennis, M. B. MITZMAIN (*Pub. Health Rpts.* [*U. S.*], *31* (*1916*), *No. 19, pp. 1172–1177*).—"*A. punctipennis* has been proved to be a definitive host of tertian plasmodial infection. Under the conditions cited, 32.5 per cent of the 40 mosquitoes applied were positive as against 10.5 per cent of the *A. crucians*. Only 20 specimens of *A. punctipennis* survived six days or longer after biting.

"With a blood donor of low infectivity 13 mosquitoes of *A. punctipennis* showed infection from 6 to 25 days after securing parasitized blood. Eight of the positive specimens became infective as shown by moderate to immense numbers of typical sporozoits invading the salivary glands. In a control series of 19 specimens of *A. crucians*, two were infective with the parasites of *Plasmodium vivax* 11 and 13 days after biting the blood donor.

"The infectibility of *A. punctipennis* was demonstrated in the transmission of the disease through the biting of four mosquitoes which reproduced the infection in three healthy volunteers, living in New Orleans during February, 1916, after incubation periods of 14 and 15 days. One of these persons had escaped infection four months previously from the bites of more than 200 *A. punctipennis* in two experiments with the subtertian type. From this single instance it is indicated that *A. punctipennis* served as a host of *P. vivax* but not of *P. falciparum*."

See also a previous note (E. S. R., 35, p. 361).

The influence of various concentrations of sea water on the viability of the salt marsh mosquitoes Aedes sollicitans and A. cantator, F. E. CHIDESTER and R. PATTERSON (*Ent. News*, *27* (*1916*), *No. 6, pp. 272–274*).—A preliminary report of experiments conducted at the New Jersey Experiment Stations. The records indicate clearly that in the field *A. sollicitans* lives and thrives in marsh water of a higher salinity than that which seems favorable to *A. cantator*.

A mosquito collecting device, T. H. D. GRIFFITTS (*Jour. Amer. Med. Assoc.*, *67* (*1916*), *No. 2, p. 117, fig. 1*).—An apparatus combining the principles of the fly trap for use in capturing mosquitoes is described and illustrated. It is stated that of 80 specimens of *Anopheles crucians*, caught and retained in five collecting tubes and placed under lantern globes closed with mosquito netting, only one escaped in 24 hours.

Mycetobia and the classification of the Diptera, F. KNAB (*Ent. News*, *27* (*1916*), *No. 6, pp. 259–262, figs. 2*).

Notes on some genera of Syrphidæ with descriptions of new species, R. C. SHANNON (*Proc. Ent. Soc. Wash.*, *18* (*1916*), *No. 2, pp. 101–113*).

Synopses of Zodion and Myopa with notes on other Conopidæ, N. BANKS (*Ann. Ent. Soc. Amer.*, *9* (*1916*), *No. 2, pp. 191–200*).

Description of two new tachinids, C. H. T. TOWNSEND (*Ent. News*, *27* (*1916*), *No. 5, p. 217*).—*Doryphorophaga aberrans* reared from the Colorado potato beetle and from *Blepharida rhois* at Blacksburg, Va.; and *Euphorocera floridensis* reared from *Anticarsia gemmatilis* at Gainesville, Fla., are described as new to science.

A tachinid parasite reared from an adult capsid, M. D. LEONARD (*Ent. News*, *27* (*1916*), *No. 5, p. 236*).—The author records the rearing of *Phorantha occidentis* from *Miris dolobrata* at Ithaca, N. Y.

Rearing of Winthemia quadripustulata from rhynchophorous larva, H. L. PARKER (*Ent. News*, *27* (*1916*), *No. 5, p. 236*).—The author records the rearing of *W. quadripustulata* on January 7 from rhynchophorous larvæ taken December 5 while following a plow in a sod field near Hagerstown, Md.

New Tachinidæ from North America, H. E. SMITH (*Proc. Ent. Soc. Wash.*, *18* (*1916*), *No. 2, pp. 94–98*).

More light on Myiophasia, J. M. ALDRICH (*Proc. Ent. Soc. Wash., 18 (1916), No. 2, pp. 98–100, fig. 1*).

Note on Myiophasia aenea, C. H. T. TOWNSEND (*Proc. Ent. Soc. Wash., 18 (1916), No. 2, pp. 100, 101*).

Observations on the habits and parasites of common flies, G. S. GRAHAM-SMITH (*Parasitology, 8 (1916), No. 4, pp. 440–549, pls. 10, figs. 24*).—In continuing investigations of flies (E. S. R., 30, p. 756) the author has studied their wintering habits, seasonal distribution and abundance of species, natural enemies, etc. He concludes that among the common species of flies the very great majority of individuals pass the winter as pupæ, or more rarely as larvæ which pupate early in the spring; that a very small and unimportant minority of both sexes emerging from pupæ late in the autumn or even in the winter possibly survive as adults until spring; that the wintering habits of *Musca domestica* are still obscure; and that the "critical" point for *Calliphora erythrocephala*, *Fannia manicata*, and *F. scalaris* seems to be about 48 to 50° F., and for *Ophyra leucostoma* about 63°.

A list of 55 references to the literature is included.

The changes of the blowfly larva's photosensitivity with age, B. M. PATTEN (*Jour. Expt. Zool., 20 (1916), No. 4, pp. 585–598, figs. 12*).—This is a report of experiments carried on with blowfly (*Calliphora erythrocephala*) larvæ, in which tests were made each day from hatching until pupation in order to determine what, if any, changes take place in the sign or the degree of their reaction to light. The decrease in sensitivity was found to occur coincidently with the beginning of the migratory period.

The spike-horned leaf-miner, an enemy of grains and grasses, P. LUGINBILL and T. D. URBAHNS (*U. S. Dept. Agr. Bul. 432 (1916), pp. 18, pls. 2, fig. 1*).—This is a report of studies of *Cerodonta dorsalis*, a dipteran known since 1861 as a corn leaf miner, but which has lately been observed to work as readily in barley, millet, wheat, oats, and various grasses. It has a wide range of distribution within the United States, occurring from Indiana and Ohio in the North to southern Florida in the South, and from Massachusetts in the East to Washington, California, and New Mexico in the West, and has been collected from Porto Rico and Mexico.

The injury to plants is caused (1) by the adults puncturing the leaves on which to feed and oviposit, and (2) by the larvæ which mine in the leaves and sometimes in the stems of young, tender plants having only a limited area of leaf surface. Mines started in the leaves of such young plants are often continued down into the heart after reaching the base of the leaf to a point near or slightly below the surface of the ground. Up to the present time this species has never been recorded as a serious pest of agricultural crops. The most severely infested field observed was one of barley at Yuma, Ariz., in April, 1915, in which about 5 per cent of the plants were infested.

The eggs are deposited either on the upper or lower sides of the leaves, one in each puncture. The largest number of eggs recorded as having been deposited by a single individual was 188 and the longest period of oviposition, 33 days. Observations made at Tempe, Ariz., Columbia, S. C., and Glendale and Pasadena, Cal., have shown the period of incubation to vary from 3 to 12 days during the spring and summer months. The length of the larval stage ranges from 9 to 24 days during different seasons and in different localities. They pupate in the mines, usually in the leaf sheath. The length of the pupal stage varies from 9 to 12 days during the midsummer and from 11 to 16 days during spring and late fall in the latitude of Columbia, S. C.; from 14 to 18 days at Tempe, Ariz., during March and April; and from 12 to 24 days at Pasadena, Cal., at different seasons of the year. The adults appear to be most active when the

temperature ranges between 85 and 95° F., but when it falls below 70° they become sluggish in their movements. There are said to be at least three generations at La Fayette, Ind., from the middle of May to October 1, apparently six generations in the latitude of Columbia, S. C., and at least eight generations during the year in the vicinity of Pasadena, Cal. The average length of the life cycle is 44 days in the vicinity of Pasadena, 26.5 days from June to August at Columbia, S. C., and 37.5 days during April and May at Tempe, Ariz. Winter is passed in the pupal stage.

A large number of parasitic Hymenoptera have been reared from this leaf miner, namely, *Cirrospilus flavoviridis, Cyrtogaster occidentalis, Diaulinus websteri, Diaulinopsis callichroma, Polycystus foersteri, Dacnusa* n. sp., *Chrysocharus parksi, Opius dimidiatus*, and *O. aridus*, which may be responsible for the almost complete disappearance of this leaf miner during midsummer in some localities. Preventive measures mentioned include fall plowing or any thorough cultivation of grain fields to destroy the remaining stems and leaves as well as volunteer grain, and the burning of dry grasses along fence lines, etc., in late fall and early spring.

A list of 14 references to literature is appended.

Contribution to our knowledge of American Siphonaptera, K. JORDAN and N. C. ROTHSCHILD (*Ectoparasites, 1 (1915), No. 1, pp. 45–60, figs. 17*).—This includes descriptions of three new genera, four new species, and several new subspecies of American fleas.

On a Nosema (Nosema pulicis n. sp.) parasitic in the dog flea (Ctenocephalus felis), V. T. KORKE (*Indian Jour. Med. Research, 3 (1916), No. 4, pp. 725–730, pl. 1*).—In dissections made of dog fleas at the Central Research Institute at Kasauli, India, the author has found frequent infections of the digestive tract by a new species of Nosema, which he has named *N. pulicis*. Fleas taken from a dog, about one in every six of which were infected, were placed in a breeding cage and fed daily on wild black rats. This resulted in the spread of the parasite so that practically every other larva was infected in about three weeks' time.

A catalogue of Philippine Coleoptera, W. SCHULTZE (*Philippine Jour. Sci., Sect. D, 11 (1916), Nos. 1, pp. 94; 2, pp. 95–194*).—A classified catalogue of the Philippine beetles.

A review of North American tortoise beetles, H. S. BARBER (*Proc. Ent. Soc. Wash., 18 (1916), No. 2, pp. 113–127, figs. 3*).

A new enemy of the black locust, G. CULBERTSON (*Proc. Ind. Acad. Sci., 1914, pp. 185, 186; Ann. Rpt. Ind. Bd. Forestry, 15 (1915), pp. 166–168*).—A beetle (*Chalepus dorsalis*) is reported to have worked extensively in the leaves of locust in four counties of southern Indiana during June and July, 1914.

Biology of Cerambyx heros, A. BARBEY (*Bul. Soc. Vaud. Sci. Nat., 5. ser., 50 (1915), No. 187, pp. 621–635, figs. 8*).—This longicorn beetle, widespread throughout Europe, but occurring much more frequently in the central and southern parts of the Continent, is the source of considerable injury to the oak.

The cane-borer beetle in Hawaii and its control by natural enemies, F. MUIR and O. H. SWEZEY (*Hawaiian Sugar Planters' Sta., Ent. Bul. 13 (1916), pp. 102, pls. 3, figs. 31*).—The first part of this work deals with the history of the search for parasites and introduction of the tachinid *Ceromasia sphenophori* from British New Guinea into Hawaii, successfully accomplished in August, 1910, an account of which by Swezey has been previously noted from another source (E. S. R., 33, p. 256). Then follows an account of the life history, habits, distribution, natural enemies, etc., of the cane-borer beetle (*Rhabdocnemis obscura*), much of the data relating to which have been previously published. Artificial means of control and natural enemies in Hawaii, next taken

up, are followed by an account of the breeding and distribution of the tachinid in Hawaii.

In a discussion of the benefits derived from the introduction of the tachinid, it is shown that the reduction in the borers has resulted in a greater yield of good cane per acre, and a further increase in the yield of sugar per acre through the improvement of the quality of the juice. The number of tons of cane required to make a ton of sugar was reduced in successive years from 11.04 tons in 1911 to 9.37 tons in 1914. In many places it is now difficult to find injury by the borer where formerly much cane was injured. While the tachinids are difficult to find, it has been shown that they can locate borers even where scarce and are able to keep up their existence.

A list of 40 references to *R. obscura* is included.

Seven appendixes comprise papers by F. Muir, namely, Report on Investigations in South China (pp. 52–57), Notes on the Sugar-cane Hoppers and Borers in the Malay States and Java (pp. 58–64), Entomological Work in Borneo (pp. 65–73), and Report on the Search for the Sugar-cane Borer in the Malay Archipelago (pp. 74–79)[1]; Report on the Sugar-cane Borer in the Moluccas (pp. 80–87), previously noted from another source (E. S. R., 22, p. 362); Concluding Report on Travels in the Malay Archipelago in Search of Parasites for the Cane Borer (pp. 88–93), and Report on Second Trip to British New Guinea to obtain a Tachinid Fly Parasitic on the Sugar-cane Beetle Borer (pp. 94–102)[2]. An account by Illingworth of the introduction of *C. sphenophori* from Hawaii into Fiji has been noted (E. S. R., 32, p. 350).

Orchard bark beetles and pinhole borers, and how to control them, F. E. Brooks (*U. S. Dept. Agr., Farmers' Bul. 763 (1916), pp. 15, figs. 18*).—Brief accounts are given of the fruit-tree bark beetle (*Scolytus rugulosus*), the peach-tree bark beetle (*Phlœotribus liminaris*), the apple wood-stainer (*Monarthrum mali*), and the pear-blight beetle (*Anisandrus pyri*), and the manner of combating them.

The determination of the abdominal and thoracic areas of the cerambycid larvæ as based on a study of the muscles, F. C. Craighead (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, pp. 129–146, figs. 4*).

Scientific queen rearing, C. W. Quinn (*Science, n. ser., 43 (1916), No. 1122, pp. 939, 941*).—Following a brief reference to the work by Newell previously noted (E. S. R., 33, p. 159), the author reports the results of crossing experiments with golden Italian and gray Caucasian bees.

The Isle of Wight bee disease, A. D. Imms (*Jour. Roy. Agr. Soc. England, 75 (1914), pp. 62–70, fig. 1*).—A popular summary of knowledge of this disease of bees, due to *Nosema apis*, with remedial and preventive measures. A list of nine references to the literature is included.

A new bee of the genus Dianthidium, S. A. Rohwer (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, pp. 192, 193*).

Notes on the biology of Paraphelinus speciosissimus, W. R. McConnell (*Ann. Ent. Soc. Amer., 9 (1916), No. 1, pp. 97–102*).—This is a report of observations of *P. speciosissimus* at Hagerstown, Md., where it has been reared from Hessian fly puparia.

The species was described in 1911 from a single specimen taken on a granary window at Urbana, Ill. It has been reared by the author from puparia in wheat stubble collected at six localities in central Pennsylvania, but has not been found to occur at other points in Pennsylvania, or in Maryland, Virginia, and West Virginia. This species is a primary multiple parasite of the Hessian

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[1] Hawaiian Sugar Planters' Sta., Ent. Circ. 1 (1907); 2 (1907); 4 (1908); 6 (1908).

[2] Hawaii, Planters' Rec., 1909, Nov.; 1910, Oct.

fly, from one to ten, with an average of seven, individuals having been reared from each puparium. Its complete development from oviposition to emergence was found to require from 18 to 20 days during July and August, and there appear to be three or four generations a year.

A few observations on the apple maggot parasite, Biosteres rhagoletis, C. A. Good (*Canad. Ent., 48 (1916), No. 5, p. 168*).—In these notes, supplementing data by Woods (E. S. R., 34, p. 456), the author records the occurrence of *B. rhagoletis* near Digby, Nova Scotia, where it was observed to parasitize the larvæ.

One new genus and five new species of ichneumon flies, H. L. Viereck (*Proc. Biol. Soc. Wash., 29 (1916), pp. 165–171*).

New miscellaneous chalcidoid Hymenoptera with notes on described species, A. A. Girault (*Ann. Ent. Soc. Amer., 9 (1916), No. 3, pp. 291–308*).—Among the species of economic importance are *Ablerus perspeciosus* n. sp., reared from the West Indian peach scale in Japan; *Habrocytus obscuripes*, reared in connection with the strawberry weevil at St. Paul, Minn.; *Uscanopsis carlylei* n. g. and n. sp., reared from an egg mass of *Membracis tectigera*, Port of Spain, British West Indies; *Oligosita oophagus* n. sp., reared from an egg mass of a leafhopper embedded in a leaf of sugar cane, Diego Martin, British West Indies; *Gonatocerus triguttatus* n. sp., reared from an egg mass of a leafhopper on orange, Caroni, British West Indies; *Aprostocetus whitmani* n. sp., reared from the eggs of *Physonota unipunctata* at St. Paul, Minn.; *Cheiloneurus albicornis*, reared from *Pulvinaria* spp. on poison ivy and from *Physokermes piceæ* at Madison, Wis.; *Ooctonus quadricarinatus* n. sp., reared in connection with bark beetles from limbs of pine infested with *Pityogenes hopkinsi*, at Syracuse, N. Y.; *Sympiesomorphelleus bicoloriceps* n. sp., reared from Tinea on Solanum; *Eupelminus coleopterophagus* n. sp., reared in connection with the strawberry weevil at St. Paul, Minn.; *Hemænasoidea oculata* n. g. and n. sp., reared from *Pseudococcus citri* on bamboo at Manila, P. I.; etc.

Life history of Habrocytus medicaginis, a recently described parasite of the chalcis fly in alfalfa seed, T. D. Urbahns (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 4, pp. 147–154, pl. 1, fig. 1*).—This is a report of observations of *H. medicaginis*, a parasite of *Bruchophagus funebris*, commenced in the fall of 1912 and continued into 1915. Laboratory studies were conducted at Glendale and Pasadena, Cal., while field observations and collections extended over several States west of the Rocky Mountains. The parasite was first reared by the author from alfalfa seed collected at Yuma, Ariz., in August, 1912, and subsequently from collections of alfalfa seed made at points in the different alfalfa seed-growing districts between the Rocky Mountains and the Pacific coast, including California, Idaho, Utah, and Oregon. Specimens from New Mexico, Kansas, and South Dakota have also been examined.

The author's observations show that a larva of this species may completely destroy its host and become fully developed within a minimum period of five or six days after taking its first food. Under a condition of dryness, such as is brought about by hot desert winds, a resting period varying from a week to a year may follow. Development continues upon the return of warm moist conditions.

The minimum length of the larval stage as observed by the author was normally about 12 days, the maximum a year or more. The prepupal form requires two or three days, and the pupal stage varies from 10 days under favorable field conditions in midsummer to 52 days in March and April. Observations show that a period of from about 30 days to one year, and almost two years in exceptional cases, may be required for the completion of a single

generation. It hibernates in the larval stage within the infested alfalfa seeds which remain on the standing alfalfa, or on the ground when winter approaches. The undeveloped larvæ and those still in the pupal stage are usually killed by the first severe frost. In the mild climate of southern California occasional individuals of this species hibernate in the pupal stage.

The comparative rearings of *H. medicaginis* and their host (*B. funebris*) show parasitism by *H. medicaginis* in several localities to be about as follows: Corcoran, Cal., 0.8 per cent; Tulare, Cal., 2.8 per cent; Chino, Cal., 2.8 per cent; and Yuma, Ariz., 4.9 per cent.

Description of eleven new species of chalcid flies, A. A. Girault (*Canad. Ent., 48* (*1916*), *Nos. 3, pp. 100–103, pl. 1; 4, pp. 113–116*).—Among the species of economic importance here described as new are *Phænodiscus partifuscipennis*, reared from the hemispherical scale in California, and *Baoanusia africana*, a parasite of *Lecanium oleæ* in Cape Colony, Africa.

Descriptions of and observations on some chalcidoid Hymenoptera, A. A. Girault (*Canad. Ent., 48* (*1916*), *Nos. 7, pp. 242–246; 8, pp. 265–268*).—Among the species described as new are *Diaulinus intermedius* reared from *Phytomyza chrysanthemi* at Kingston, R. I.; *Psuediglyphomyia coptodiscæ* from *Coptodisca splendoriferella*, Madisonville, Ky.; *Trichogrammatomyia tortricis* n. g. and n. sp., from the eggs of *Tortrix cerasivorana*, Guelph, Ontario, in the second paper.

A new genus of pteromalid chalcidoid Hymenoptera from North America, A. A. Girault (*Canad. Ent., 48* (*1916*), *No. 7, pp. 246–248*).

A new genus of lelapine chalcid flies from the United States, A. A. Girault (*Canad. Ent., 48* (*1916*), *No. 8, pp. 263, 264*).

The pear leaf-worm, R. L. Nougaret, W. M. Davidson, and E. J. Newcomer (*U. S. Dept. Agr. Bul. 438* (*1916*), *pp. 23, pls. 2, figs. 4*).—This is a report of observations and experiments with a pear sawfly (*Gymnonychus californicus*) made in California during the seasons 1911 to 1914, inclusive, and in the State of Washington during the seasons of 1914 and 1915.

The injury by this sawfly is caused almost entirely by its partial defoliation. It is quite abundant in the localities in which it occurs, and occasionally becomes a pest of serious consequence. So far as known it is a native of the Pacific coast. It is of economic importance only as an enemy of the different varieties of pears.

"There is only one generation each year. The adult or parent sawflies issue in March and April, the female sex greatly predominating. Eggs are inserted into the pear leaves, the resultant larvæ or worms feeding upon the foliage for an average period of three weeks. The larvæ may be found on the leaves during April and May, and in Washington the season is perhaps ten days or two weeks later than in California. Upon acquiring full growth the larvæ drop to the ground and bury themselves in the topmost inch of soil (a few go as deep as 3 or 4 in.) and weave around themselves a brown, oval, tough cocoon in which the insect remains for slightly over ten months, at first as larva and later for a period of two or three weeks as a pupa. At the end of the pupal stage the adult issues from the cocoon and comes forth from the ground, and thus the cycle is completed. . . .

"What few natural enemies the insect has are quite unable to control it. Artificial remedies are correlative with those used against the codling moth and also against the pear-thrips larva. . . .

"In cases of ordinary infestation the contact spray, such as is used for thrips larvæ or aphids, will prove successful in controlling the larva of the pear leaf-worm. When the infestation is severe and promises the defoliation of limbs or whole trees the poison spray should be used. The best time for appli-

cation is when the largest larvæ are about half grown and when the holes in the leaves are not larger than 0.5 in. in diameter. At this time nearly all the eggs have hatched."

Some American Hymenoptera, J. C. Crawford (*Proc. Ent. Soc. Wash., 18 (1916), No. 2, pp. 127, 128*).

The citrus mite named and described for the first time, E. A. McGregor (*Ann. Ent. Soc. Amer., 9 (1916), No. 3, pp. 284–290, figs. 13*).—The citrus mite, formerly considered identical with *Penthalodes mytilaspidis*, is here described from material taken on lemon leaves at Orlando, Fla., as *Tetranychus citri* n. sp. It was introduced into California from Florida on nursery stock about 1890, and is doubtless the most injurious red spider found on citrus trees on the Pacific coast. It is severest as a pest of sweet orange in California, whereas in Florida it all but forsakes the sweet orange, and is severe only upon lemon, sour orange, and grapefruit. The citrus red spider on orange in California produces a silvering, dwarfing, and dropping of the fruit, and also causes discoloration and dropping of the foliage.

A new mite from the Hawaiian Islands, P. J. O'Gara (*Science, n. ser., 44 (1916), No. 1126, p. 142*).—The author records observations of injury to the Chinese litchi tree (*Litchi chinensis*), growing on the grounds of the Federal Experiment Station at Honolulu, by a mite which is apparently a new species of Eriophyes.

The dispersal of leaf-blister mite of cotton, (*Agr. News [Barbados], 15 (1916), No. 368, p. 186*).—Data are presented which indicate that the leaf-blister mite of cotton can be introduced in the seed. Observations have also shown that the full-grown mites have a tendency to ascend to the tips of leaf hairs and assume what appears to be a waiting position, the first pair of legs being extended and with which they attach to any moving object that comes in contact with them. It is suggested that leaf-blister mites would in this way attach to insects and birds and be disseminated by them.

FOODS—HUMAN NUTRITION.

On the use of certain yeast nutriments in bread making, R. A. Kohman, C. Hoffman, T. M. Godfrey, L. H. Ashe, and A. E. Blake (*Jour. Indus. and Engin. Chem., 8 (1916), No. 9, pp. 781–789, figs. 3*).—Experiments here reported were carried out to determine the effect of certain mineral salts, such as are commonly found in natural waters, upon the fermentative activity of the yeast and also upon the quantity of yeast necessary for leavening purposes. The mineral substances present in flour, milk, yeast, and other raw materials used in bread making were also studied. The following conclusions are drawn:

"By the use of minute quantities of ammonium and calcium salts and potassium bromate in bread, from 50 to 65 per cent of the usual amount of yeast can be saved. Incident to the economy in yeast thus effected, there is a saving of about 2 per cent of fermentable carbohydrates, calculated upon the total flour used, due to the greatly diminished consumption of these by the yeast.

"The proper use of nutrient salts for the yeast gives greater control over the dough batches and aids in the production of better and more uniform bread, regardless of the locality. The added salts conserve the inherent qualities of the dough and consequently maintain its stability and strength to a far greater degree than by the old process. The finished loaves are improved in quality, flavor, texture, bloom, and uniformity."

A cause of mustiness in bread, A. M. Wright (*Jour. Soc. Chem. Indus., 35 (1916), No. 20, pp. 1045, 1046*).—Examination for micro-organisms of flour alleged to have been the cause of mustiness, observed in bread baked from it, showed the presence of *Rhizopus nigricans* and Aspergillus.

Sound, palatable bread was sterilized and portions were mixed with filtered and fluid extracts of the two species of molds and incubated for 24 hours at 37° C. The samples treated with the *R. nigricans* extract developed a marked mustiness and a slight sourness in the odor and flavor, while those treated with the Aspergillus extract developed sourness in odor and flavor. Neither mustiness nor sourness was noted in samples of the sterilized bread incubated as a check. The conclusion was drawn that *R. nigricans* is capable of producing mustiness in bread while Aspergillus produced merely sourness. The changes in the bread associated with mustiness are regarded by the author as being probably brought about by the proteolytic enzym of *R. nigricans*.

Manufacture of [soy] bean milk at Changsha [China], N. T. JOHNSON (*U. S. Dept. Com., Com. Rpts., No. 183 (1916), pp. 468, 469*).—The bean milk described is prepared from the small yellow [soy] bean from which the Chinese bean curd is made. The beans are soaked and crushed between stones and the crushed mass is strained, diluted in water, and boiled, after which the white milk is strained off. The milk has a specific gravity of 1.02 and a fat content of 3.125. The milk is prepared at night, bottled, and delivered fresh to the customers in the morning.

Biochemistry of cod-liver oil, C. FUNK (*Biochem. Bul., 4 (1915), No. 14–15, pp. 365–370*).—A preliminary report is given of experiments in which nitrogenous substances, to which are attributed the therapeutic action of cod-liver oil, were separated from the fatty constituents of the oil. Crude cod-liver oil was used, since this is richer in organic bases than the purified product.

Physiological and pharmacological studies on coal tar colors.—I, Experiments with fat-soluble dyes, W. SALANT and R. BENGIS (*Jour. Biol. Chem., 27 (1916), No. 2, pp. 403–427*).—This investigation was undertaken to furnish information regarding the reactions produced in the body by synthetic dyes. The questions regarding their effect on health, often raised in connection with their use in the preparation of foods, emphasizes the need of such information.

In this paper data are reported regarding the effect of the following fat-soluble dyes: Benzeneazo-β-naphthylamin, Yellow A. B.; tolueneazo-β-naphthylamin, Yellow O. B.; benzeneazobenzeneazo-β-naphthol, Sudan III; benzeneazo-β-naphthol, Sudan I; benzeneazodimethylanilin, Butter Yellow; benzeneazophenol, Oil Yellow; benzeneazoresorcinol, Sudan G.; aminoazobenzene, Spirit Yellow. These dyes were administered subcutaneously, intraperitoneally, intravenously, and by mouth to laboratory animals (rabbits and cats). The results of the investigation are summarized by the authors as follows:

"Oil-soluble and water-insoluble dyes administered to different animals were eliminated in the urine and in the bile. Elimination in the urine was usually inhibited in poisoning with zinc or oil of chenopodium. Two of the compounds of benzeneazophenol and benzeneazoresorcinol, which were isolated from the urine of rabbits, proved to be conjugated with glucuronic acid.

"Most of the dyes were deposited in the adipose tissues; staining of the nervous tissue, the kidney, and muscle was also observed in some experiments. Ten to 15 hours after intravenous injection of 25 mg. per kilo of benzeneazoresorcinol, the dye was still present in the blood.

"The toxicity of the different dyes was not pronounced even when larger doses were administered."

[Food and drug inspection], E. F. LADD and ALMA K. JOHNSON (*North Dakota Sta. Spec. Bul., 4 (1916), No. 7, pp. 163–178*).—The results are reported of the examination of several samples of foods and beverages, information is given regarding several patent medicines, and the results reported of the sanitary inspection of various establishments where foods are prepared and sold.

The food problem in wartime from the standpoint of a physician, L. DEVOTO (*Atti Soc. Ital. Prog. Sci.* [*Rome*], *8* (*1916*), *pp. 475–500*).—A summary of generally accepted principles in nutrition, with special reference to the economic effects resulting from underfeeding during the present war.

The increase in the cost of food for different classes of society since the outbreak of war, FRANCES WOOD (*Jour. Roy. Statis. Soc., 79* (*1916*), *No. 4, pp. 501–508*).—A summary and digest of statistical data.

The food value of Great Britain's food supply, W. H. THOMPSON (*Econ. Proc. Roy. Dublin Soc., 2* (*1916*), *No. 11, pp. 168–220*).—This paper reports the results of a survey of the food supply. This included a collection of data regarding the total quantity of food available; a study of the quantities of protein, fat, carbohydrate, and energy which these foods would furnish; and a calculation of the quantity of food available per inhabitant. The average daily ration per person thus obtained is compared with the requirements of a number of European and American dietary standards.

A bibliography and an appendix of statistical data are included.

The German food supply and its political economy, H. SCHUMACHER (*Deutsche Volksernährung und Volksernährungspolitik im Kriege. Berlin: Carl Heymann, 1915, pp. VII+92*).—The opening sections of this pamphlet deal with the domestic food supply and possible ways of increasing it by means of reclaimed land, improved methods of agriculture, and a more careful utilization of the available fertilizers. There is a brief discussion of the food materials formerly imported and means of meeting the deficiency occasioned by the shutting off of trade.

In considering the measures taken by the Government to regulate the utilization of the available food supply, special emphasis is laid on the laws governing the consumption of breadstuffs and the economic reasons for high prices and price control. The relation of feeding stuffs to human food is also dwelt on, with particular emphasis on the utilization of potatoes.

The appendix reprints a poster addressed to German women, written by the author and used extensively in railway stations, in which the necessity for small economies is emphasized. There is also a memorandum of practical means of reducing consumption in the kitchen and of advice in choosing and storing foodstuffs, and a brief bibliography of the general subject of the pamphlet.

Studies on the growth of man, I–IV, T. B. ROBERTSON (*Amer. Jour. Physiol., 37* (*1915*), *No. 1, pp. 1–42, 74–85, figs. 2; 41* (*1916*), *No. 5, pp. 535–546, 547–554, figs. 4*).—Four articles are presented.

I. *The prenatal and postnatal growth of infants* (pp. 1–42).—This article is a study of various characteristics of the growth of infants, based upon statistical data in a large maternity hospital.

II. *The postnatal loss of weight in infants and the compensatory overgrowth which succeeds it* (pp. 74–85).—In the case of a large number of South Australian infants it was found that male and female infants suffered an equal retardation of growth, which after one week was 9.2 per cent of the weight at birth. By the end of the second week 48 per cent of the loss in the case of the male and 84 per cent in the case of the female had been regained. The entire loss was made good at the end of the first month.

III. *The growth of British infants during the first year succeeding birth* (pp. 535–546).—The data reported in this paper are based on records supplied by infant welfare associations in the cities of London and Leeds. From these data a curve was constructed showing the growth of British infants during the postnatal period of 12 months. and determinations were made of variations due

to sexual and environmental differences. The characteristics of the growth curves of British infants were also compared with those of the growth curves of South Australian infants of British descent.

IV. *The variability of the weight and stature of school children and its relationship to their physical welfare* (pp. 547–554).—Data are reported regarding the variability of weight and height of school children from 7 to 14 years of age, and the influence of environment upon these variabilities.

From the seventh to the fifteenth year the rate of increase in weight of both sexes was found to increase. The variability in weight underwent a parallel increase during this period, and stature also increased at an almost uniform rate. Variability of stature was uniform and much less than variability of weight.

The author regards the measure of stature as a more reliable criterion of abnormality than the measure of weight, but states that as a sensitive indicator of the effects of environmental, physiological, or dietetic fluctuations the measure of weight is to be preferred to that of stature, provided statistical methods of investigation are employed. "Among children of 8 years of age increasing unfavorability of environment and lack of medical care resulted in a parallel increase in deficiency of weight and stature, accompanied by a decrease in the variability of weight and an increase in the variability of stature."

The use of boiled milk in infant feeding and elsewhere, J. BRENNEMANN (*Jour. Amer. Med. Assoc., 67 (1916), No. 20, pp. 1413–1419*).—In this article the author reports his clinical experience with the use of boiled milk in infant feeding, which shows, in his opinion, that boiled milk possesses several advantages over raw or pasteurized milk. Earlier work has been noted (E. S. R., 29, p. 360).

The use of malt soup extract in infant feeding, B. R. HOOBLER (*Jour. Amer. Med. Assoc., 67 (1916), No. 20, pp. 1420–1422, figs. 2*).—Methods are outlined for the use of malt soup in the infant dietary.

The relation of diet to beri-beri, E. B. VEDDER (*Jour. Amer. Med. Assoc., 67 (1916), No. 21, pp. 1494–1497*).—Experiments of the author and others are summarized, and from the data presented he formulates the following dietary rules for the prevention of deficiency diseases:

"In any institution where bread is the staple article of diet, it should be made from whole wheat flour. When rice is used in any quantity, the brown undermilled, or so-called hygienic rice, should be furnished.

"Beans, peas, or other legumes, known to prevent beri-beri, should be served at least once a week. Canned beans or peas should not be used. Some fresh vegetable or fruit should be issued at least once a week and preferably at least twice a week. Barley, a known preventive of beri-beri, should be used in all soups.

"If corn meal is the staple article of diet, it should be yellow meal or water-ground meal—that is, made from the whole grain. White potatoes and fresh meat, known preventives of beri-beri and scurvy, should be served at least once a week, and preferably once daily. The too exclusive use of canned goods must be carefully avoided."

The influence of flesh feeding on urinary creatinin, D. BURNS and J. B. ORR (*Biochem. Jour., 10 (1916), No. 3, pp. 495–503*).—Data are reported regarding the amount of creatinin excreted when meat or creatin was added to an otherwise creatin-free diet. The subjects of the experiments were normal young men.

The experiments showed that the ingestion of meat caused an increased excretion of creatinin and generally the appearance of creatin in the urine,

although the amount of the increase was not proportional to the amount of meat eaten. Although cooking increased the amount of creatinin present in meat, cooked meat did not necessarily cause a greater increase in urinary creatinin than uncooked meat. Creatinin administered by the mouth was eliminated as such only to a slight extent and did not greatly change the excretion of creatinin.

Feeding experiments with a dietary in which tyrosin is reduced to a minimum, G. TOTANI (*Biochem. Jour., 10 (1916), No. 3, pp. 382–398*).—Experiments were conducted with laboratory animals (rats) to obtain information regarding the necessity for tyrosin in the diet. In one experiment caseinogen, freed as completely as possible from tyrosin, was used as the basis of the diet, and in another both hydrolyzed and nonhydrolyzed gelatin were used. The results of the work are summarized as follows:

"Tyrosin could not be isolated quantitatively from the hydrolysis products of caseinogen. When the removal of tyrosin from the amino-acid mixture is made as complete as possible and is effected to an extent which certainly leaves only minimal quantities of this constituent, there appears to be no effect upon the nutritive value of the amino-acid mixture.

"In the case of the rat, the nutritive efficiency of gelatin is greatly increased by previous hydrolysis. Gelatin when fed intact appears to be badly digested and absorbed. The possibility of completely replacing the protein of a diet by hydrolyzed gelatin, plus certain amino acids, is confirmed.

"Some evidence is offered that the addition of tryptophane alone to the hydrolysis products obtained from pure gelatin made these efficient in maintaining the nutrition of animals."

Feeding experiments with kynurenic acid, C. ASAYAMA (*Biochem. Jour., 10 (1916), No. 3, pp. 466–472, figs. 4*).—Laboratory animals (rats) were given a basal diet, which supplied all of the amino acids of protein except tryptophane. To this diet tryptophane was added in one series of experiments, and kynurenic acid, a metabolic product of tryptophane, in another series. Determinations of the body weight and the general nutritive condition of the animals showed that the nutritive value of the diet was enhanced by the addition of tryptophane, but when tryptophane was absent from the food no improvement of nutrition was observed on the addition of kynurenic acid.

The rôle of leucocytes in the work on intermediary metabolism of carbohydrates, P. A. LEVENE and G. H. MEYER (*Ann. Inst. Pasteur, 30 (1916), No. 4, pp. 155–159*).—In the experiments here reported leucocytes, practically free from bacteria, were found to convert six carbon chain-sugars into methylglyoxal, and this in turn into lactic acid. By substituting glucose derivatives for glucose it was found that glycolytic enzyms of animal tissues had no effect on those hexoses in which one or more hydrogen atoms had been replaced by other radicals.

The mechanism of cholesterol absorption, J. H. MUELLER (*Jour. Biol. Chem., 27 (1916), No. 2, pp. 463–480*).—The experiments here reported were carried out with laboratory animals (dogs). In studying the mechanism of cholesterol absorption analyses were made of the gastric and intestinal contents. After feeding cholesterol the absorption of cholesterol was followed through a thoracic duct fistula with experimental elimination of certain of the gastric juices. Experiments were carried out in vitro dealing with the possible action of various enzyms upon cholesterol.

The data obtained showed that bile was more closely connected with cholesterol absorption than with that of neutral fats. Experiments in vitro showed that "free cholesterol, in the presence of fatty acids and a suspension

of pancreas, undergoes esterification, and from control experiments it seems most likely that this is a real action by the pancreas."

Analysis of the intestinal mucosa during starvation and after feeding showed that an esterification of a large part of the absorbed cholesterol had taken place. No evidence was found that the mesenteric lymph nodes took any part in cholesterol absorption.

The cholesterol esters were found to be more resistant to the ordinary active bipases, no evidence of splitting being found, although neutral fat in the same mixture was easily saponified. In the opinion of the author the data obtained by no means explain the whole process of cholesterol absorption.

"Since no effect of the mucosa could be demonstrated in vitro, it is at least possible that the esterification may take place in the lumen of the intestine under the influence of the pancreatic juice, and that the esters may be absorbed as rapidly as formed."

A study of the electrolytic method of silver cleaning, H. L. Lang and C. F. Walton, Jr. (*U. S. Dept. Agr. Bul. 449* (*1916*), *pp. 12*).—This bulletin reports the results of a laboratory investigation of the so-called electrolytic method of cleaning silver by bringing it in contact with a more active metal, like aluminum or zinc, while immersed in a solution of some electrolyte. Preliminary tests were made with a number of commercial devices, which showed that these are generally satisfactory. A number of factors influencing the efficiency of the method were studied, such as the effect of temperature and concentration of the cleaning solution and the relative advantages of zinc and aluminum as the active metal and of sodium carbonate and sodium bicarbonate as the electrolyte. Also, directions were formulated for the household application of this method.

Aluminum was found to be more satisfactory than zinc as the active metal, because the zinc soon becomes covered with a layer of basic zinc carbonate and hence loses its efficiency. Sodium carbonate or sodium bicarbonate, with or without the addition of sodium chlorid, was found to be equally effective as the electrolyte. It was found that the cleaning solution should be kept at the boiling temperature to secure the most satisfactory results.

The loss in weight of sterling silver and plated silver spoons cleaned 50 times by the electrolytic method was from 1.9 to 4.3 mg. This was insignificant and only about 4 per cent of the loss in cleaning with an abrasive silver polish. This is due to the fact that in the electrolytic method the tarnish of silver sulphid is reduced to metallic silver instead of being cut away by the abrasive in the older type of silver polishes.

ANIMAL PRODUCTION.

The respiratory exchange of animals and man, A. Krogh (*London and New York: Longmans, Green & Co., 1916, pp. VIII+173, pls. 3, figs. 31*).—The topics treated in this monograph are the physiological significance of the exchange of oxygen and carbon dioxid; methods for measuring the respiratory exchange; the exchange of nitrogen, hydrogen, methane, ammonia, and other gases of minor importance; the standard metabolism or the organism (definism and determination); the influence of internal factors upon the standard metabolism; the influence of chemical factors upon the respiratory exchange; the influence of physical factors upon the respiratory exchange; the variations in standard metabolism during the life cycle of the individual; and the respiratory exchange in different animals. An extensive bibliography is included.

The growth and variability in the body weight of the albino rat, Helen D. King (*Anat. Rec., 9 (1915), No. 10, pp. 751–776, figs. 5*).—The author finds that "when environmental conditions are uniform the growth of albino rats within a given colony tends to follow the same course and to produce individuals having a like weight at any stated age.

As a rule the male rat is heavier than the female at birth and also at all subsequent ages at which records were taken. During the first 60 days of postnatal life the body weight of the female tends to approach that of the male, but after this age the male grows more rapidly than the female and soon greatly exceeds her in body weight. At 200 days of age the male rat weighs, on the average, about 70 gm. more than the female of the same age. The female tends to increase in body weight at a much more rapid rate than does the male during the early stages of development, and she reaches her maximum weight much earlier than does the male.

"The environmental and nutritive conditions under which rats are reared have a marked influence on their body weights, as is indicated by the relation of the growth graphs constructed from data obtained from three different series of rats reared under different conditions. Variability in the body weight of the albino rat, as measured by the coefficients of variation, is greatest when the animals are about 60 days of age. It decreases slightly at 90 days, and after 120 days remains practically constant until the animals are about one year old. Very young female rats seem to show as great a range of variability in body weight as do the males, but the males are more variable than the females at all later stages of growth. The average coefficient of variation for the body weights of the 50 male rats used in this study is 13.6; that for the females is 12.1.

"In the rat there is apparently a direct correlation between the rapidity of growth and the variability in body weight after the animals have reached 60 days of age. The records collected are not in a form to give evidence regarding the correlation that exists at earlier stages of growth. Fraternal variability in the rat is less than racial variablity. For the male rate the fraternal variability is about 70 per cent that of the general population; for the female it is about 55 per cent."

On the influence of exercise on the growth of organs in the albino rat, S. Hatai (*Anat. Rec., 9 (1915), No. 8, pp. 647–665*).—The author experimented with the albino rat in order to discover the effect of long-continued exercise.

"The heart, kidneys, and liver show an average excess of about 20 per cent, while the spleen shows a similar amount of deficiency. The brain weight shows an average excess of 4 per cent, while no change is noticed in the case of the spinal cord. The ovaries give an excess of 84 per cent, while the testes give an excess of 12 per cent. The hypophysis, as well as the suprarenals, respond differently to exercise according to sex. Furthermore, these two organs show, as the result of exercise, an approach to the relations characteristic for the Norway rat. The exercised rats were either entirely free from lung infection or but slightly affected. The control rats, on the other hand, had badly infected lungs and in some series several of them were lost, presumably from the lung disease. Analysis of the data shows that the lung infection is not responsible for the changes observed in the organs."

On the composition and physiological activity of the pituitary body, I, II, F. Fenger (*Jour. Biol. Chem., 21 (1915), No. 2, pp. 283–288; 25 (1916), No. 3, pp. 417–422*).—The first part of this investigation was conducted for the purpose of determining whether any seasonal variation exists in the pituitary

body from cattle. Such a seasonal variation would be expected to be most pronounced between glands obtained at the height of the outdoor season and those secured at the coldest period of the year, and for this reason two summer and two winter months were chosen for collection. In order to determine the difference, if any, in physiological activity between glands from various species of animals, pituitary bodies from hogs were also collected during the summer months.

It was found that the posterior lobe of the pituitary body of the hog was twice as large, in proportion to the weight of the entire gland, as that in cattle. The physiological activity of the posterior lobe, when determined according to the isolated uterus method, was practically the same for cattle (herbivora) as for hogs (omnivora). No distinct seasonal variation in activity and chemical composition of the posterior lobe of the pituitary body was found in cattle. Approximately 10 per cent of the beef glands contained colloid masses secreted between the anterior and posterior lobes. This material was insoluble in acidulated water, and did not possess any pronounced uterine-contracting power.

The material for the second study was selected from a large number of noncastrated calves from two to four months old as well as from full-grown steers. It was found that the pituitary bodies from young animals were slightly more active than the glands from full-grown cattle. This is in accordance with conditions found in other ductless glands, such as the thyroid, thymus, and suprarenals. The infant gland contained more phosphates, both in the anterior and posterior lobes, than glands from fully mature animals. The uterine-contracting active principle of the posterior lobe of the pituitary body was readily extracted from the fresh glands by water and also by neutral acidulated methyl or ethyl alcohol. The acidulated methyl-alcohol extract was more than twice as strong as the water extract, and somewhat stronger than pure crystalline β-imidazolylethylamin hydrochlorid.

Commercial feeding stuffs, W. J. Jones, Jr., F. D. Fuller, E. G. Proulx, C. Cutler, and J. H. Roop (*Indiana Sta. Bul. 190* (*1916*), *pp. 23–360, fig. 1*).—This bulletin gives the objects and provisions of the state feeding-stuffs law, terms adopted by the Association of Feed Control Officials, and other data relating to feeding-stuffs inspection.

Analyses are tabulated of alfalfa meal, blood meal, brewers' dried grains, distillers' dried grains, dried chicken blood, coconut meal, corn bran, corn feed meal, corn-germ meal, gluten feed, gluten meal, cottonseed meal, cottonseed feed, cold-pressed cotton seed, cottonseed hulls, dried beet pulp, fish scrap, ground bone, hominy feed, linseed meal, malt sprouts, meat meal, meat scrap, oat middlings, buckwheat hulls, buckwheat middlings, low-grade flour, red dog flour, rye middlings, tankage, wheat bran, wheat middlings, and mixed, proprietary, and condimental feeds.

Concentrated commercial feeding stuffs, J. D. Turner and H. D. Spears (*Kentucky Sta. Bul. 203* (*1916*), *pp. 251–333*).—In addition to the usual notes on the enforcement of the state feeding-stuffs law, this bulletin gives grades for commercial corn and results of analyses of alfalfa meal, granulated bone, meat scrap, tankage, dried beet pulp, cracked corn, corn-feed meal, hominy feed, cotton-seed meal, linseed meal, rye feed, wheat bran, wheat middlings and shorts, brewers' dried grains, distillers' dried grains, and mixed and proprietary feeds.

The following table gives the amino-acid content of various protein substances, as determined by E. H. Nollau:

Distribution of nitrogen in protein substances.

Kind of material.	Kind of nitrogen.								
	Ammonia.	Melanin.	Cystin.	Arginin.	Histidin.	Lysin.	Amino of filtrate (monoamino acid).	Nonamino of filtrate (prolin, oxyprolin, tryptophane, etc.).	Total.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Soy bean	12.97	3.69	1.52	15.52	2.60	7.02	48.76	7.12	99.20
Distillers' dried grains	13.06	8.21	3.02	11.27	.00	4.79	50.68	10.66	101.70
Cottonseed meal	14.06	6.27	2.74	12.77	7.57	1.94	45.02	7.49	97.86
Cowpeas	11.83	9.57	6.74	15.98	.00	3.56	46.70	.58	94.96
Wheat bran	9.67	13.75	5.96	12.53	3.84	4.04	49.95	.00	99.74
Maize kernel	4.63	7.00	4.06	16.19	4.45	8.53	49.69	.00	94.55
Hemp seed	9.93	4.15	2.05	21.38	3.01	6.71	44.20	5.28	96.73
Rice	10.23	9.98	6.97	11.94	3.18	.00	38.83	15.90	97.03
Sunflower seed	15.42	5.73	2.98	16.80	4.56	4.86	45.32	5.27	100.92
Rolled oats	13.12	2.60	5.22	12.12	10.54	.00	46.99	12.68	103.27
Oat grain	13.31	2.97	4.48	11.42	9.58	.00	43.49	11.29	96.54
Sprouted oats	13.18	2.40	5.32	11.26	9.61	.70	41.61	12.48	96.56
Barley grain	16.19	2.87	4.38	8.65	6.70	.00	44.16	18.37	101.32
Rye grain	15.00	1.54	2.20	10.49	10.48	1.24	37.96	21.63	100.52
Tankage	10.03	6.88	2.46	12.34	2.18	2.50	54.73	9.01	100.13
Dried blood	6.19	5.69	2.02	7.72	8.37	9.97	51.53	3.94	95.44
Unroasted peanut	10.93	4.36	.81	20.82	6.13	5.31	52.36	1.40	99.12
Black walnut	10.71	4.53	1.27	23.77	5.98	3.49	45.01	3.12	97.90
Shellbark hickory nut	9.47	6.59	1.58	24.24	6.66	3.37	43.25	7.48	103.61
Pecan	9.43	6.21	2.87	6.91	21.91	3.25	42.28	7.89	100.75
Gluten flour	22.99	1.31	2.12	8.86	5.18	.40	49.19	7.67	97.72
Gluten (wheat)	22.53	1.01	1.91	7.61	5.57	.51	49.05	9.76	97.95
Wheat	16.49	10.29	1.60	5.26	8.36	.96	41.06	17.95	101.97
Cantaloup seed	7.51	6.42	1.18	19.39	12.05	5.93	35.36	13.66	101.50
Gelatin	1.41	.51	....	18.72	3.65	9.58	40.87	23.22	98.02
Proprietary calf meal	8.59	9.29	....	14.58	19.80	.67	36.76	14.18	103.87

[Animal husbandry studies] (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 41 (1915), pp. 32–34*).—Alfalfa hay was compared with oat straw for steer feeding for 118 days, the groups being given the same grain ration, as well as silage and the hay or straw 4:1. The steers in the alfalfa group made an average daily gain of 1.82 lbs. per steer, and those in the straw group 1.54 lbs. The alfalfa-fed steers made more rapid gains than those getting straw, but they consumed a great deal more feed, the gains made costing 11.51 and 11.37 cts. per pound, respectively. Financially, therefore, the results were very similar, though the steers fed alfalfa showed a little better finish than those fed straw.

An experiment was conducted to determine whether the addition of a high-protein feed, such as cottonseed meal, to the ration of steers receiving a low-protein, bulky ration would prove beneficial. One group was fed oat straw, corn silage, and meal from mixed home-grown grains, and a second group was fed the same bulky feed and the same kind and amount of mixed meal, with the addition of a small allowance of cottonseed meal constituting 20 per cent of the mixture. The group fed cottonseed meal made an average daily gain per steer of 1.58 lbs., and the other group, 1.54 lbs., but it is concluded that the feeding of cottonseed meal was not profitable.

Five lots of weanling pigs were fed as follows: Lots 1 and 2, commercial brands of tankage, with grain and water; lot 3, beef meal, grain, and water; lot 4, grain and water; and lot 5, skim milk and meal. These pigs made average daily gains per pig of 1.01, 1.06, 0.93, 1.01, and 1.09 lbs., costing per pound of gain, 4.33, 4.1, 4.48, 3.61, and 5 cts. for the respective lots.

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In a second test five lots of 3-month-old pigs were fed as above. These pigs made average daily gains per pig of 1.14, 1.19, 1.1, 1.2, and 1.33 lbs., costing per pound of gain 4.23, 4.07, 4.76, 3.34, and 4.32 cts. for the respective lots.

Three lots of pigs were fed the same grain ration and an equal allowance of skim milk, lot 1 running on rape pasture, lot 2 on clover pasture, and lot 3 in dry pen. These pigs made average daily gains per pig of 1.01, 1.16, and 1.19 lbs., costing per pound of gain 4.4, 4.08, and 4.26 cts. for the respective lots.

Feeding for beef in Alberta, G. H. HUTTON and W. H. FAIRFIELD (*Canada Expt. Farms Sta. Bul. 30, 2. ser.* (*1916*), *pp. 38, figs. 19*).—This bulletin reports feeding experiments with steers conducted at the Lacombe and Lethbridge substations from 1909 to 1915, the results of which have for the most part been noted from the annual reports of the Canada Experimental Farms (E. S. R., 36, p. 65).

One hundred and two head of 2 and 3 year old cattle of average quality grazed on a fenced portion of well-watered pasture of native prairie grass at Lacombe during the summer of 1915 made an average gain of 358 lbs. per head. The grazing period in this test varied from 150 to 175 days.

The characteristics of sheep wool and a new chemical method of determining its quality, K. VON ALLWÖRDEN (*Ztschr. Angew. Chem., 29* (*1916*), *No. 17, Aufsatzteil, pp. 77, 78, fig. 1*).—This article treats of the structure, elasticity, quality, and general physical characteristics of wool fiber, and describes a chemical method for determining its quality.

The fleece of coarse-wool sheep, S. N. KOVALEVSKIĬ (*Selsk. Khoz. i Liesov., 250* (*1916*), *Jan., pp. 20–67, figs. 31*).—Experiments were undertaken to determine the moisture content, commercial weight, and fat content of wool, the effect of washing upon foreign substances, the loss through carbonization, and the fineness, elasticity, and strength of the fibers.

It was found that the wool close to the skin may successfully take the place of Merino wool, and even excel it in strength when tested for tearing. The hair of all kinds of wool is subject to polymorphism in the shape and position of epidermal scales. The coarser parts of the hair are covered with small scales disposed bridge-wise at its thicker parts, while at the thin places, which are generally void of core, the scales are in the shape of small laminæ. The possibility of recognizing the race of sheep according to the scales of the hair can take place only after the study of all variations belonging to one and the same race. The bluish tint belonging to the Romanoff sheep is due to the two colors of the intermediary hair, which is dark at the top and gray at the bottom.

It is suggested that studies should be made of the under wool to determine its properties and its quantity. The caracul lower and upper wool ought to be experimented with as to the quantity of down in the wool. Scientific investigation of the wool should precede the establishment of sheep-breeding methods for the purpose of increasing the quantity and quality of wool.

Sorrel color in horses, L. P. MCCANN (*Jour. Heredity, 7* (*1916*), *No. 8, pp. 370–372*).—A study was made of records in the Belgian studbook covering a total of 427 matings and involving the color of over 1,250 animals.

"The chestnut by chestnut matings, while few in number, serve to demonstrate that sorrel is recessive to chestnut. In order to conform exactly to Mendel's law the offspring should be in the proportion of three chestnuts to one sorrel, and they do approach this proportion rather closely, being 13 to 5, respectively. There is a predominance of sorrels as compared to chestnuts in the Belgian breed studied, and it would therefore be expected that a larger number of the chestnut animals would be heterozygous for sorrel than if these two colors were present in equal numbers. This is more clearly shown in the chest-

nut by sorrel matings. Again considering the matter theoretically, if the two colors were present in equal numbers there should be fewer sorrels than chestnuts resulting from this cross, but there are 23 sorrels to 11 chestnuts. The same thing is brought out in the sorrel by bay matings. The sorrels and bays are present in about the proper proportions, but theoretically there should be a larger number of chestnuts.

"The bay by chestnut matings also substantiate the fact that sorrel is recessive to chestnut. If such were not the case the number of sorrels from this cross would be very small as compared to the others, but the result is 22 sorrels, 48 bays, 8 chestnuts, and 1 black.

"The sorrel by black matings give a result similar to the chestnut by black matings. The former gives 9 sorrels, 8 bays, 1 roan, 1 chestnut, and 6 blacks, and the latter, 1 sorrel, 2 bays, 1 brown, 1 roan, 1 chestnut, and 1 black, showing that sorrel and chestnut are qualitatively alike.

"The fact that the sorrel by sorrel cross gives sorrel offspring in practically 100 per cent of the cases is rather definite proof that sorrel is a unit character, and further, that it is recessive to all other colors. Therefore the breeder who is desirous of producing sorrel animals has an easier task than the one who desires to produce animals of a color other than sorrel. The former will be certain of getting sorrel colts as long as he has a sire and dam of sorrel color, while the latter can not be certain of the results from the cross of any other color."

DAIRY FARMING—DAIRYING.

Milk production cost accounts: Principles and methods, C. W. Larson (*New York: Columbia University Press, 1916, pp. 60*).—In this discussion the attempt is made to analyze each item of cost and also to apply the methods and practices of recognized authorities in factory cost accounting as far as they may be applied to milk production cost. The production cost of milk is discussed under the divisions feed; labor; indirect or overhead expenses, such as buildings, cattle, bedding, sire, etc.; and returns for calves and manure.

A method of precalculating feed costs is explained, which, it is stated, is quick and easy and can be applied to any system of feeding. In calculating the total cost of cattle in milk production the annual depreciation is obtained by the formula $\frac{x-y}{n}$, in which x represents the cost of the cow, y the sale price of discarded cow, and n the years of usefulness. To the amount thus obtained are added insurance, taxes, and interest on first cost of cow.

In summarizing cost and credits incident to milk production the author states that "under the conditions stated for each item, which include a particular size and kind of cow, producing 8,500 lbs. of 4 per cent milk with feeds at stated prices, with the system of management given, and with a good barn well equipped for the production of high-grade milk, cost records will show the following as actual costs in the production of milk: Feed, \$75.29; labor, \$27; buildings, \$8.24; cattle, \$9.21; bedding, \$3.25; sire, \$3.51; miscellaneous expenses, \$24.25; total cost, \$150.75; with credits of calves, \$3; manure, \$20; net cost per cow per year, \$127.75." On this basis the cost of production per 100 lbs. of milk is \$1.50.

"Under present prices of feed and labor a herd of high-producing cows will when properly managed return 5 per cent interest on the capital invested in a good plant, and an additional 5 per cent for services of the manager not included in regular labor charge. The average cow of the United States does not produce enough milk to pay the cost of production when managed under the same conditions and equipped to produce high-grade milk. Where the herd uses

feeds that can not be marketed, where a cheaper system of management is used, and where the cows are housed in cheaper buildings and given less care, they may pay the cost of production of milk. Under some conditions, summer dairying would be more profitable than the all-year practice. It does not pay to use intensive methods or winter grain feeding with low producing cows. The value of pasture for dairy cows has been underestimated."

A bibliography of related literature is given.

Labor requirements of dairy farms as influenced by milking machines, H. N. HUMPHREY (*U. S. Dept. Agr. Bul. 423* (*1916*), *pp. 17, figs. 3*).—This is a study of the milking machine as a factor in the organization of the dairy farm. The data were obtained from 109 dairy farms in New York, representative of the intensive type of dairy farm, and from 160 dairy farms in Ohio, Michigan, and Illinois, representative of a mixed type of farm wherein dairying is combined with general farming. In each of the localities studied a number of mechanical milking machines was found.

The author summarizes the results of his studies as follows:

"The time saved by the use of the mechanical milker increases with increase in the size of the herd. With herds of 15 cows or less the average time required to milk a cow by hand is a fraction over 7 minutes; by machine a fraction under 5 minutes. With herds of over 50 cows it takes slightly under 7 minutes to milk a cow by hand and but 4.15 minutes by machine. With herds of over 50 cows one man with a machine milks on the average about 28 cows per milking as against 17 where the milking is done by hand.

"With increase in the size of the herd the cost per cow of hand milking changes very little, while the cost per cow of machine milking decreases rapidly. With herds of 15 cows or less the average cost of milking per cow by hand is $10.91 per year as against $10.45 in herds of 50 or more. With herds of 15 cows or less the average cost of milking per cow by machine is $11.77 per year as against $7.34 for herds of 50 or over.

"Although with the average small herd of 15 cows or less it costs more per cow to milk by machine than by hand, it does not follow that the machine is necessarily an unprofitable investment on all farms on which such small herds are kept. On 32 farms having herds of 15 cows or less the use of the mechanical milker was found to effect an annual saving in hired labor of $2.63 per cow through the dropping of hands who had been kept primarily to do the milking."

Statistical weighting for age of advanced registry cows, C. W. HOLDAWAY (*Amer. Nat., 50* (*1916*), *No. 599, pp. 676–687, figs. 2*).—Results are given of a study made for the purpose of determining whether the records of the various breed associations are consistent with their standards, and whether these standards can be used as a basis for weighting cows of different ages. Using 7-day records secured from the Holstein-Friesian Blue Book data are tabulated of 9,639 A. R. O. record female progeny of the Holstein bull, Paul De Kol, No. 14,634. From this population correlation coefficients were worked out, and curves were plotted for milk and fat production, showing (1) the requirements of the Holstein-Friesian Association, (2) the mean of the population, (3) the plus deviation from the mean, and (4) what the requirements ought to be according to the performance of the cows studied.

From an inspection of the curves of milk production the author points out "that the official requirements weight animals of an age from 18 to 21 months too heavily. The curve indicates that they are entitled to a reduction as great as for any other age. For the purpose of discouraging such early breeding, however, the requirements for this particular class should be prohibitive and they are. The production increases up to at least 6 years of age instead of 5, which the Holstein-Friesian Association requirements set as the maximum age

production. For this reason the 5- to 6-year-old animals and possibly the 7- to 8-year classes have an advantage over all other classes. A comparatively small number of animals made the requirement after 9 years of age, hence by selection, only the best animals were retained, thus drawing the curve down almost to a straight line."

Data are also tabulated and correlation coefficients worked out for 456 female A. R. O. progeny of the Holstein cow, Aaggie Grace, No. 2,618. These data agree in the essential points with those secured from the progeny of Paul De Kol.

Liver meal for milch cows: Its influence on milk and dairy products, H. ISAACHSEN (*Tidsskr. Norske Landbr., 23 (1916), No. 2, pp. 65–94*).—On account of the high protein content liver and other detritus of fish is considered a valuable concentrated feeding stuff. Large amounts of it are exported to France and Germany.

In feeding experiments with cows, liver meal had a tendency to decrease the fat content of milk, and as the decrease lasts for several months it is of economic importance. No reason is assigned for the decrease of fat in the milk. The fat content in the milk of cows on pasture was greater than that of cows kept in barns. In the test 0.8 kg. of liver meal produced as much milk as 1 kg. of cottonseed meal. Two kg. of liver meal per cow daily for 15 days produced no bad results, and no change of taste in the milk or butter was noticed.

A study of factors affecting the composition of sheep's milk, J. FABRE (*Ann. École Nat. Agr. Montpellier, n. ser., 13 (1914), No. 2–3, pp. 113–120*).—As a result of analyses of milk of Larzac sheep on different days, at different milkings during the same day, and of different portions of the same milking, the author concludes that for the most part the factors which affect the composition of cow's milk act in a like manner on the composition of sheep's milk. Under the influences studied the fat content of the milk showed the widest variation.

[Dairy industry in New Zealand], D. CUDDIE (*New Zeal. Dept. Agr. Ann. Rpt., 24 (1916), App., pp. 21–33*).—A review is given of the dairy industry of New Zealand for the year ended March 31, 1916.

It is stated that the year was one of the most profitable ever experienced for the majority of farmers engaged in this industry. During the year 792,838 packages (396,419 cwt.) of butter and 591,810 packages (weight not given) of cheese were exported, being a decrease of 1.8 per cent of butter and an increase of 11.9 per cent of cheese as compared with the exports of the previous year.

The milk supply of Paris before and during the war, J. E. LUCAS (*Ann. Sci. Agron., 4. ser., 4 (1915), No. 10–12, pp. 422–453, fig. 1*).—In addition to a statistical review of the milk supply of Paris since 1896, the author reports a study of the effects of the European war on the production, transportation, distribution, and cost of milk used in Paris. Suggestions for increasing the supply are included.

The bacteriological examination of fresh milk, J. RITCHIE (*Pub. Health [London], 29 (1916), No. 11, pp. 270–274*).—Results are given of the bacteriological examination of 140 samples of milk from dairies throughout Dumfriesshire County, Scotland, during the year 1914. Of these samples 62 were found to contain under 50,000 bacteria per cubic centimeter and 78 samples over 50,000. The bacterial content of the milk was found to be correlated with the sanitary conditions under which it was produced. The author concludes that the value of the test for *Bacillus enteritidis sporogens* as applied to milk is exextremely small.

Bacterial testing versus dairy inspection, C. E. NORTH (*Amer. Jour. Pub. Health, 6 (1916), No. 6, pp. 569–578*).—In this paper the author points out that the primary purpose of bacterial testing of milk by the use of the bac-

terial count is to determine its sanitary character, and that of dairy inspection to prevent the contamination of milk and to see that it is properly refrigerated. The growth of the two systems of inspection is reviewed. It is stated that up to the present time the tendency has been toward separate organizations for the two kinds of inspection with an undercurrent of competition between them. The author, however, believes that our present knowledge of the utility of the two methods justifies the establishment of more definite relationship, with complete cooperation between the two and a readjustment of their functions.

Some observations on causes of high bacterial counts in market milk, H. D. PEASE (*Amer. Jour. Pub. Health, 6 (1916), No. 6, pp. 563–568*).—The author concludes that where adequate field and laboratory control of milk supplies has been in operation for a number of years, high bacterial counts are generally caused through inefficiently cleaned apparatus and by the incubation of bacteria on moist surfaces of cans or other utensils, or that taking place in the product itself due to inefficient refrigeration. In localities where no supervision has been in operation and where the producers are more or less slovenly the rather uniform high bacterial counts found in milk are generally due to dirty conditions.

The experience of New York City in grading market milk, L. P. BROWN (*Amer. Jour. Pub. Health, 6 (1916), No. 7, pp. 671–677*).—The author gives an account of how New York City has dealt with the problem of controlling its milk supply. The essentials of New York's milk control system are described as (1) pasteurization of all milk except that intended for special uses, (2) in connection therewith the maintenance of bacteriological standards, (3) the labeling of all packages intended to go to the consumer, and (4) constant inspection and supervising of pasteurizing plants.

A statement is given of the chief successive steps that have been taken for the control of the city's milk supply which have led up to the system now in effect, together with a short description of the methods used in the inspection of pasteurization plants and equipment.

The pasteurization of milk from the practical viewpoint, C. H. KILBOURNE (*New York: John Wiley & Sons, 1916, pp. IV+248, figs. 34*).—This handbook for milk dealers, students in dairy schools, public officials having control of milk handling, and the general public, relates to the installation, operation, and control of pasteurizing plants. The subjects dealt with are pasteurization in general, heaters, holders, temperature controllers, and recorders, cleaning and cooling the milk, efficiency of various apparatus, and changes in the cream line due to the pasteurization of milk.

Milk clarifiers, C. BAHLMAN (*Amer. Jour. Pub. Health, 6 (1916), No. 8, pp. 854–857; abs. in Cream. and Milk Plant No. 5 (1916), No. 1, pp. 41, 42*).—As a result of bacteriological and chemical studies upon milk clarifiers made by the Cincinnati Department of Health, the author states that eight samples of raw milk averaging 1,312,000 bacteria per cubic centimeter showed an average increase of 27 per cent in bacterial content after being clarified. The ordinary sediment test applied to these samples of milk showed that the clarifier had removed all gross suspended dirt from the milk. The average weight of the material deposited in the clarifier was 1.6 gm. of moist sludge, equivalent to 0.6 gm. of dry material per gallon of milk. This material contained large numbers of bacteria and on analysis was found to consist largely of substances normally present in milk. Fresh certified milk also yielded a deposit when passed through the clarifier. The seemingly greater number of bacteria in clarified milk is thought to be due to the breaking apart of clumps of bacteria by the mechanical action of the clarifier.

Some observations on homogenized milk and cream, H. B. BALDWIN (*Amer. Jour. Pub. Health, 6 (1916), No. 8, pp. 862–864, figs. 2*).—The author notes the development and occasional fraudulent use of the process of homogenization in the milk industry, and gives the results of two sets of measurements of fat globules in samples of homogenized cream from two different machines working under pressures of from 700 to 4,000 lbs. per square inch.

The degree of homogenization was found to be generally increased with the pressure, and in one of the machines the destruction of fat globules was so great that no spherical forms could be observed through a one-twelfth in. oil-immersion objective. The diameter of most of the homogenized fat globules ranged between 0.001 to 0.002 mm. in diameter, whereas the majority of normal milk fat globules range in diameter from 0.005 to 0.006 mm.

Condensed milk in Bermuda, S. W. EELLS (*U. S. Dept. Com., Com. Rpts., No. 241 (1916), pp. 168, 169*).—The author states that Bermuda annually imports about 720,000 cans of condensed milk, of which about 15 per cent is unsweetened or evaporated. On account of poor pastures and the cost of fodder the prospects for the production of fresh milk on the islands are not good. Evaporated milk stands the climate well. The American brands of unsweetened condensed milk are considered best by most dealers, though there is a prejudice among consumers in favor of Canadian and European brands. Nearly all the sweetened condensed milk comes from Europe, but some is now imported from Canada.

Suggestions for the manufacture and marketing of creamery butter in the South, R. C. POTTS and W. WHITE (*U. S. Dept. Agr., Off. Sec. Circ. 66 (1916), pp. 11*).—This circular contains practical suggestions on the management of creameries and the manufacture and marketing of creamery butter in the South.

VETERINARY MEDICINE.

Report of the veterinary director general for the year ended March 31, 1915, F. TORRANCE (*Rpt. Vet. Dir. Gen. Canada, 1915, pp. 131, pls. 7, figs. 3*).—Following the main part of this report (pp. 3–33) dealing with the work of the year on the more important diseases of animals and import testing are 17 appendixes. Among the more important of these are the report of the pathologist at the biological laboratory, Ottawa (pp. 71–76), including papers on The Care, Sanitation, and Feeding of Foxes in Captivity (pp. 77–94) and An Economical Measuring Device (pp. 98, 99), by C. H. Higgins; and Is *Leucocytozoon anatis* the Cause of a New Disease in Ducks? by A. B. Wickware (pp. 95–97), previously noted from another source (E. S. R., 33, p. 483), as well as later work (E. S. R., 36, p. 85); report of the pathologist at the veterinary research laboratory at Lethbridge, Alberta (pp. 100, 101), including a report on Dourine and the Complement-Fixation Test (pp. 101–119), by E. A. Watson; and a report of the pathologist at the research laboratory at Agassiz, British Columbia, in which S. Hadwen deals briefly with tick paralysis, etc. (pp. 120–123).

Annual report for 1914 of the principal of the Royal Veterinary College, J. McFAYDEAN (*Jour. Roy. Agr. Soc. England, 75 (1914), pp. 252–269, figs. 4*).—This report deals principally with the occurrence of and work with anthrax, glanders, foot-and-mouth disease, sheep scab, swine fever, tuberculosis, contagious abortion, and Johne's disease. Considerable attention is given to the treatment of the last-mentioned disease, data relating to which have been previously noted (E. S. R., 35, p. 76).

A new model of double pipette holder and the technique for the isolation of living organisms, F. HECKER (*Jour. Infect. Diseases, 19 (1916), No. 3, pp.*

306–314, figs. 6).—A new apparatus and its use and manipulation in the isolation of living organisms are described in detail.

Lupines as poisonous plants, C. D. Marsh, A. B. Clawson, and H. Marsh (*U. S. Dept. Agr. Bul. 405 (1916), pp. 44, pls. 4, figs. 2*).—The introductory part of this bulletin gives a summary of knowledge of lupines as poisonous plants and accounts of their distribution, common names, alkaloids, etc. The second part (pp. 7–28), which deals with experimental work, takes up pharmacological investigations by Sollmann, field experiments with lupines, and laboratory experiments with extracts of lupine seed upon mice. The third part (pp. 28–42) is devoted to a discussion and general conclusions.

"An investigation by Sollmann showed the presence of alkaloids in American lupines, and pointed to the probability that most, if not all, the poisoning of live stock in America was due to these alkaloids and not to ictrogen. Extended field work has verified the conclusions of Sollmann and has shown that all aerial parts of the lupines examined are poisonous, the seeds being the most toxic, then in order the pods and leaves. This has been confirmed by preliminary experiments with extracts upon mice.

"The toxic substance is excreted by the kidneys; the intoxication is not cumulative, and animals may eat comparatively large quantities with no ill results, if the toxic limit is not reached at any one time. Inasmuch as the toxic and lethal limits are nearly the same, the prognosis for poisoned animals is not favorable. There is no form of remedial treatment that can be used advantageously for range animals. Poisoning in most cases can be avoided, even where the plant is abundant, by careful handling of the flocks, especial care being taken to see that hungry sheep are not grazed on fields where there is much lupine."

A list of 29 references to the literature is included.

Studies on the action of glycerin.—I, The hemolytic action of glycerin in vitro and in vivo, I. Simon (*Arch. Farmacol. Sper. e Sci. Aff., 20 (1915), Nos. 3, pp. 120–144, figs. 4; 4, pp. 145–165, fig. 1; abs. in Chem. Zentbl., 1916, I, No. 1, p. 25*).—The blood of cattle and rabbits was hemolyzed by glycerin in all concentrations. The time necessary for hemolysis was found to increase with increasing concentrations of glycerin, and to reach a maximum at a concentration of 55 per cent for cattle blood and 50 per cent for rabbit blood. With increasing concentrations of the glycerin the rate of hemolysis increased rapidly.

Subcutaneous and intraperitoneal injections in rabbits produced serious local lesions and a general toxicity. When the amount of glycerin injected exceeded 2.5 gm. per kilogram of body weight a hemoglobinuria resulted, regardless of the strength of the glycerin injected.

The theory of the action is discussed.

A contribution to the action of amino acids, peptids, and proteins on hemolysis by cobra venom, E. Zunz and P. György (*Jour. Immunol., 1 (1916), No. 5, pp. 531–569*).—Detailed experimental results are submitted which show that the effects of amino acids, peptids, and proteoses on cobra venom hemolysis vary according to the species of blood corpuscles used and also the amount in the blood-venom mixture.

"The hemolytic action of cobra venom on the red cells of guinea pig's blood is markedly hastened and increased in intensity by phenylglycocoll, leucin, glycyltryptophan, and protoalbumose. The hemolysis is produced more quickly in the presence of large quantities than it is with small amounts of phenylglycocoll and leucin. Heteroalbumose tends slightly to increase the intensity of the hemolysis; alanin, on the contrary, diminishes it a little. Glycocoll and particularly diglycin, triglycin, and leucylglycin inhibit the hemolysis in direct proportion to their concentration.

"In the presence of 0.1 cc. of fresh guinea pig's serum the accelerating action of protoalbumose and of glycyltryptophan and the inhibiting action of the strong concentrations of diglycin, of triglycin, and of leucylglycin is hardly greater than that of the weaker concentrations. Heteroalbumose shows marked effects. The presence of inactive serum exercises a protective action upon the blood corpuscles. It does not interfere with the acceleration of the hemolysis by phenylglycocoll, but it does diminish the adjuvant effects of glycyltryptophan and leucin and it almost completely annihilates those of protoalbumose. It weakens considerably the marked effects of diglycin. Glycocoll and heteroalbumose appear no longer to exercise any influence on the hemolysis."

The influence of the amino acids, peptids, and proteoses upon human blood was similar to that exercised by the same products on the blood of guinea pigs. Similar observations were also made of the effect on the hemolysis of dog, rabbit, sheep, calf, and ox blood.

Anaphylaxis produced by sensitization through the vagina, A. Hamm (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 24 (1915), No. 1, pp. 1–11*).—Experiments are reported which show that guinea pigs can be readily sensitized by the introduction of the antigen into the vagina. Horse serum as well as micro-organisms isolated from the mucous membrane of the vagina were found to be absorbed and produced pronounced symptoms of anaphylaxis. True parasites, semiparasites, or true saprophytes produced the same result. The reinjection was made intravenously.

The use of polyvalent sera, L. Cuvellier (*Rev. Soc. Med. Vet. [Buenos Aires], 1 (1915), No. 4–5, pp. 254–264*).—The action of polyvalent sera in wound treatment is briefly discussed, and the successful treatment of cases in wounded horses reported in detail.

A case of anthrax, G. G. Reinle and R. A. Archibald (*Jour. Infect. Diseases, 19 (1916), No. 5, pp. 718–720, pl. 1*).—A case of anthrax in a veterinarian who had examined a cow which had died with the disease, together with detailed clinical data, is reported.

The eosinophils were found to be an important factor in the blood picture throughout the disease. After the administration of antianthrax serum a marked eosinophilia was observed. When the clinical manifestations showed signs of relapse during the course of the disease the eosinophilia disappeared. It reappeared, however, when the situation was relieved, and then gradually subsided as convalescence progressed. The important rôle played by the antianthrax serum in bringing about the recovery of the patient is pointed out.

Is Bacillus abortus pathogenic for human beings? L. H. Cooledge (*Jour. Med. Research, 34 (1916), No. 3, pp. 459–467*).—The author has failed to find proof that *B. abortus* is pathogenic for human beings. "It is possible to cause antibodies for *B. abortus* to appear in the blood serum of adults by feeding a milk which is naturally infected with *B. abortus* and which contains the *B. abortus* antibodies. Antibodies appearing as above apparently indicate a passive immunity due to the absorption in the large intestine of the antibodies present in an infected milk."

The bull as a disseminator of contagious abortion, F. B. Hadley and H. Lothe (*Jour. Amer. Vet. Med. Assoc., 50 (1916), No. 2, pp. 143–156*).—The authors' investigations are summarized as follows:

"Bulls may become infected with the abortion bacilli. Bulls with systemic infections used in the experiments were incapable of disseminating the abortion disease to virgin, abortion-free heifers by cohabitation. Bulls appear to possess a sexual or individual immunity to abortion infection that renders them less susceptible than cows and induces a more benign form of the disease. Bulls, when infected, have the ability to attenuate the infecting micro-organ-

isms in their bodies in a relatively short time, so that they will be safe for the service of noninfected cows. Cows usually acquire the abortion disease from other sources than the genitalia of bulls at the time of service."

The causative organism of foot-and-mouth disease, H. STAUFFACHER (*Ztschr. Wiss. Zool., 115 (1916), No. 1, pp. 1-57, pls. 2, figs. 29; abs. in Jour. Bact., 1 (1916), No. 3, pp. 353-355*).—This is a report of investigations at Frauenfeld, Switzerland, in which the author found an organism in the diseased tissues and blood of animals suffering from foot-and-mouth disease, to which the name *Aphthomonas infestans* is given.

Minute polymorphic structures with an average length of 1μ were found in the lymph and blood of all the 26 infected animals examined, but were never found in similar tissues of normal, healthy animals. The same bodies were found in the freshly-drawn blood, both free in the plasma and within the erythrocytes, of infected animals, thus excluding the possibility that they are products of nuclear and cellular degeneration brought about by the disease. The author has grown these bodies in the condensation water of blood agar culture media and has observed many developmental stages, has inoculated normal cattle with the organisms from the artificial cultures and produced the disease, and then recovered the organisms from the diseased tissues of the inoculated animals, thus having fulfilled Koch's postulates for the determination of a causative organism. Two distinct types were observed: One, shorter and thicker, had the characteristic appearance of a flagellated protozoon, with a lancet-formed body which becomes sharply attenuated and drawn out into a long flagellum; the other was much longer and more thread-like.

It is pointed out that the intracellular bodies with their varied forms, which, however, are reducible to one general type, are strikingly suggestive of Leishmania, particularly *L. donovani* of kala-azar.

The review is by G. N. Calkins.

Investigation on the presence of the tubercle bacillus in milk, E. E. CHARLES (*Rev. Soc. Med. Vet. [Buenos Aires], 2 (1916), No. 1-3, pp. 37-60*).—In a hygienic study of the milk supply of Buenos Aires tuberculous lesions were produced by the inoculation of samples of the common milk supply in only 1 guinea pig out of a series of 38. It is indicated, however, that these negative results should not be considered conclusive, especially in public health institutions. The literature and theoretical and experimental aspects of the subject are discussed in detail.

The clinical value of complement fixation in tuberculosis, H. R. MILLER (*Jour. Amer. Med. Assoc., 67 (1916), No. 21, pp. 1519-1521*).—Tabular data of the results of 1,012 cases of tuberculosis tested with the antigen prepared as previously noted (E. S. R., 36, p. 81) are reported, and the results discussed.

It is concluded in general that the reaction is practically always positive in active tuberculosis; nontuberculous and normal patients react negatively; the sera of syphilitics who have no clinically active tuberculosis are negative; and the test is, as a rule, negative in arrested cases. "The von Pirquet and intradermic tuberculin tests and the complement-fixation reaction are not identical or similar diagnostic procedures, since the former indicates the existence of a tuberculous lesion whether old and arrested or active, while the latter points clearly to the presence of some active focus."

The complement-fixation test carried out with the antigen described is considered to be a distinct aid in the diagnosis of early tuberculosis and in the detection of the disease when the condition is obscure.

A contribution to the chemotherapy of tuberculosis.—First experimental report, G. KOGA (*Jour. Expt. Med., 24 (1916), No. 2, pp. 107-147, pls. 5*).—Detailed experimental results of the treatment of tuberculous guinea pigs with

albumin-free tuberculin, iodotuberculin, and compounds prepared from copper salts and cyanids, designated as liquids *A*, *B*, *C*, and *D*, are reported.

The effect of a single injection of these liquids upon the tuberculous lesions was found to be either negative or inconspicuous. After repeated injections, however, the congestion and leucocytic infiltration about the lesions decreased markedly, the cheesy material resulting from degeneration of the lesions and other degeneration products appeared to be in a process of absorption, and young connective tissue was being actively produced in the periphery.

While these changes were taking place the number of the bacilli was also being reduced until finally they could no longer be detected on microscopical examination. "Hence it appears that while the preparation may lack bactericidal action in vivo powerful enough to destroy all the bacilli at one injection, yet repeated infusions may nevertheless bring about the destruction of all the bacilli and the modification of the tubercular lesion into that of the suspended stage or even into the healed condition. Whether, therefore, the preparation brings about these results directly by killing the bacilli or indirectly by favoring the healing processes of the body, nevertheless it has power to inhibit the growth of or annihilate entirely the bacilli in vivo."

So far as microscopic examination was concerned sterility of the tissues was obtained. Emulsions of the various organs of treated animals injected into healthy animals did not, however, yield consistent results, so that absolute sterility in all animals was not obtained.

A contribution to the chemotherapy of tuberculosis.—First clinical report, G. Koga (*Jour. Expt. Med., 24 (1916), No. 2, pp. 149–186, pls. 6, figs. 20*).—A number of cases are reported in detail which indicate that the preparation "liquid *D*," noted above and designated as "cyanocuprol," "greatly improves or apparently cures pulmonary and surgical tuberculosis in the first and second stages, and that it seems also to produce beneficial effects upon the disease in the third stage."

It is indicated that the duration of the beneficial effects must be established more definitely by further observations.

The etiology of bovine metritis, B. Eggink (*Aetiologie der Metritis beim Rinde. Inaug. Diss., Univ. Bern, 1914, pp. 75*).—The author briefly reviews the classification of uterine diseases as arranged by earlier investigators, and discusses the general considerations in regard to endometritis, puerperal infection and intoxication, etc. The etiology of uterine infections, bacteria found in the bovine genitals, investigation of a number of cases of metritis, the relation between metritis and post-partum polyarthritis, and the serum treatment of uterine diseases are also discussed.

It is concluded that the previously accepted classification of the various forms of metritis is a purely clinical one. Considered from the etiological standpoint there is really no difference between the various forms. They are considered to be caused by the same micro-organisms, and under the term metritis every infection of the uterus (plus its contents) should be included. There are always a greater or lesser number of virulent organisms present in the uterus which exercise their pathogenic influence either by local action on the tissues, by the production of a general toxemia, or by a combination of both. Post-partum polyarthritis is considered always to be secondary and the result of an earlier uterine infection by specific organisms.

Serum treatment in metritis, especially the injection of *Streptococcus pyogenes* antiserum as a prophylactic after difficult parturition and also as a curative agent in active infections, is recommended.

A bibliography of 69 references is included.

Bacterium pyogenes associated with a case of multiple arthritis in a hog, A. R. Ward (*Abs. in Jour. Bact., 1 (1916), No. 1, p. 114*).—It is pointed out that polyarthritis of swine is frequently encountered in post-mortem inspection of meat. *B. pyogenes* was isolated in pure culture from a case showing various stages of articular involvement from the early stages of synovitis to later stages showing erosion of articular cartilage, exostosis, and anchylosis of the joints.

Swine erysipelas and hog cholera, A. A. Ferreira (*Doenças Rubras dos Suinos e a Peste Suina. Lisbon: Assoc. Cent. Agr. Portuguesa, 1915, pp. 32, figs. 6*).—This pamphlet briefly enumerates common and rare contagious diseases of swine in Portugal and briefly discusses swine erysipelas. Hog cholera in regard to its prevalence, morbidity, diagnosis, infectivity, and immunization (simple or simultaneous vaccination) is also discussed.

Agglutinins in hog-cholera immune serum for Bacillus suipestifer, H. Wehrbein (*Jour. Infect. Diseases, 19 (1916), No. 3, pp. 446–451*).—Tabular data of the agglutinins for *B. suipestifer* in 100 hog-cholera immune sera, in the sera of 8 normal pigs, and in 8 sera of virus pigs are submitted. An experiment to ascertain the connection between the agglutinin titer for *B. suipestifer* and the antibodies in a hyperimmune serum is also reported.

Further studies on the virulent salt solution used in the production of hog-cholera serum, W. S. Robbins (*Jour. Infect. Diseases, 19 (1916), No. 5, pp. 708–711*).—Experimental data reported indicate that "virulent salt solution is not nearly so virulent as virulent blood, and that while it is efficient in hyperimmunizing by the subcutaneous method it would no doubt be impractical in the intravenous method because of the difficulty of injecting enough of it intravenously to produce very potent serum. Even if it is used in mixture with virulent blood the amount of the mixture required to produce good serum would be unusually high."

See also a previous note by Graham and Himmelberger (E. S. R., 34, p. 680).

Lameness of the horse, J. V. Lacroix (*Chicago: Amer. Jour. Vet. Med., 1916, pp. 271, figs. 62*).—The first section (pp. 15–35) of this work deals with the etiology and occurrence of lameness; the second section (pp. 37–53) with diagnostic principles; the third section (pp. 55–183) with lameness in the fore leg; and section four (pp. 185–261) with lameness in the hind leg.

The effect on horses of feed heavily inoculated with Bacillus coli isolated from oat hay, R. Graham and L. R. Himmelberger (*Abs. in Jour. Bact., 1 (1916), No. 1, pp. 115, 116*).—Studies reported by Rogers, Clark, and Evans (E. S. R., 33, p. 631) on the occurrence of the colon bacteria on grains led the authors to conduct investigations with a view to discovering a type pathogenic or virulent for live stock (see E. S. R., 34, p. 681).

"In no case were we able to produce death by feeding, but the condition in the experimental horses was such as to suggest that feeds contaminated extensively with colon bacilli lower animal vitality and render the animal more susceptible to other injury. . . . It is evident from these observations that the occurrence of *B. coli* as isolated from grain which was the causative factor of so-called 'forage poisoning' bears no primary relation to the disease resulting from the feeding of the oats, but from a sanitary standpoint it seems advisable to protect animal feeds from *B. coli* contamination in so far as possible."

Sclerostome parasites of the horse in England, I, C. L. Boulenger (*Parasitology, 8 (1916), No. 4, pp. 420–439, pl. 1, figs. 7*).—This first part deals with three species of the genus Triodontophorus, of which two are described as new to science, and one species of the genus Oesophagodontus. A bibliography of 19 titles is included.

Notes on the histopathology of the intestines in young chicks infected with Bacterium pullorum, G. E. Gage and J. F. Martin (*Jour. Med. Research, 34 (1916), No. 2, pp. 149–155*).—"In this experiment, using cultures from several sources, without exalting their virulence, it was possible to produce typical baccillary white diarrhea. Death resulted from three to ten days after the inoculation.

"Stained sections were made from various levels of the intestinal tract of all dead birds. From the study of the sections there was revealed marked injury to the mucosa, associated with hyperemia, hemorrhagic exudation, and leucocytic infiltration. In the individuals in which the disease had run a longer course there are exhibited processes of regeneration. There is in many instances a thickening of the intestinal wall. There is a marked fibroblastic proliferation, and wherever there is any of the columnar epithelium intact there is active secretion of mucus. Therefore, with these pathological conditions associated together, and repeated observations confirming them, it is evident that the important histopathological conditions in the intestines in young chicks dead of *B. pullorum* infection correspond to either an acute or beginning chronic condition of catarrhal inflammation."

The poisonous effects of the rose chafer upon chickens, G. H. Lamson, Jr. (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 2 (1916), No. 9, pp. 65, 66*).—Previously noted from another source (E. S. R., 35, p. 489).

RURAL ENGINEERING.

The flow of water in wood-stave pipe, F. C. Scobey (*U. S. Dept. Agr. Bul. 376 (1916), pp. 96, pls. 14, figs. 7*).—This is a report of 64 experiments on the flow of water in 16 different wood-stave pipes ranging in diameter from 8 in. to 13.5 ft., and of the collection and analyses of available records of all previous experiments of a similar character by others. In the experiments 13 of the pipes ranged from 8 in. to 4 ft. in diameter; one was 6.5 ft., one 12 ft., and one 13.5 ft. in diameter. Six pipes were of the machine-banded type, put together in lengths, and ten were of the continuous-stave type. Mean velocities ranged from less than 1 ft. per second to more than 8 ft. per second.

The analysis of all experiments reviewed, which combined reached a total of 286, indicated that an exponential formula most nearly applies to the flow of water in wood-stave pipes. It was found "(1) that Kutter's formula with a constant value of n does not apply to flow in wood-stave pipes running full, (2) that n decreases with an increase in velocity in a given size of pipe and increases with the size of pipe for a given velocity, varying from less than 0.01 for small pipes at high velocities to more than 0.014 in large pipes, (3) that this variation in n is so marked and complicated as to render the use of Kutter's formula inadvisable." On the basis of the analysis a new formula for flow of water in wood-stave pipes either jointed or of continuous stave construction is presented as follows:

$$H=7.68d^{-1.17}V^{1.8}=0.419D^{-1.17}V^{1.8}$$

becoming

$$H=\frac{7.68\,V^{1.8}}{d^{1.17}}=\frac{0.419\,V^{1.8}}{D^{1.17}}$$

In this formula H = the friction loss per 1,000 linear feet of pipe, V = mean velocity of water in feet per second, d = the mean inside diameter of the pipe in inches, and D = the mean inside diameter of the pipe in feet. It was found

that the application of this formula "meets (within 1 per cent) the mean of all observations and the mean capacity of all wood pipes upon which experiments have been made."

General conclusions regarding the capacity of wood-stave pipes are drawn as follows: "A very conservative factor of safety should be used where a guarantied capacity is to be attained. . . . The data now existing do not show that the capacity of wood-stave pipe either increases or decreases with age. This statement does not consider sedimentation, a purely mechanical process. If silted waters are to be conveyed, the pipe should be designed for a working velocity of from 5 to 10 ft. per second. If sand is present in the water, the design should be for a velocity of about 5 ft. per second, which will be high enough to carry out a large part of the sand and at the same time not so high as to seriously erode the pipe. The better method is to remove the sand by sumps or other means. Air should be removed from the intake end of every pipe line, especially when the capacity load is approached. Wood pipe will convey about 15 per cent more water than a 10-year-old cast-iron pipe or a new riveted pipe, and about 25 per cent more than a cast-iron pipe 20 years old or a riveted pipe 10 years old."

An appendix devoted to abstracts of descriptions of experiments made by agencies other than the Division of Irrigation Investigations of the U. S. Department of Agriculture is included, together with a discussion of the flow of water in wood-stave pipe, by G. S. Williams, T. A. Noble, D. C. Henny, E. A. Moritz, E. W. Schoder, and L. M. Hoskins.

New method of deriving weir formulas, T. R. Running (*Engin. News, 76 (1916), No. 15, pp. 695, 696, figs. 4*).—A new method of determining the rate of flow of water over weirs, especially adapted for experiments on the flow of water through pipes, is described as developed at the University of Michigan.

The main advantage of the method is that it requires only a single experiment for determining the rate of flow of water over a weir for different heads and is applicable to weirs of high as well as of low heads. The apparatus for recording the time and head is described, and the derivation of the weir formula on the basis of head and time is mathematically presented.

Design of small lined canals (*Jour. Electricity, 37 (1916), No. 15, pp. 279, 280, figs. 3*).—Curves showing the carrying capacities of small wooden flumes in second feet, miner's inches, and gallons per minute are given. The flumes vary in area of water cross section from 0.5 to 3 sq. ft. and have a fall in feet per 1,000 ft. of from 0.5 to 20. The curves are based on a value of "*n*" in Kutter's formula of 0.015. "The carrying capacity of small concrete flumes or lined ditches can also be obtained from these curves, as there is usually little difference in the friction factor."

Surface water supply of Pacific basins in Washington and upper Columbia River Basin, 1913 (*U. S. Geol. Survey, Water-Supply Paper 362-A (1916), pp. VI+264, pls. 2*).—This report, prepared in cooperation with the States of Washington, Montana, and Idaho, presents the results of measurements of flow made on the Quinault River, Puget Sound, and upper Columbia River drainage basins during 1913.

Rogue River Valley Project and Willamette Valley Investigations, J. T. Whistler and J. H. Lewis (*Oreg. Cooper. Work, Dept. Int. U. S. Reclam. Serv., 1916, Feb., pp. 111, pls. 15*).—This report was prepared in cooperation with the State of Oregon. The part covering the Rogue River Valley Project deals with the irrigation and water supply of that portion of the Rogue River Valley above Tolo, and more especialy the area in the immediate vicinity of Ashland and Medford. The average texture of soils of the area is that of a clay loam. "A duty of 1.5 acre-feet delivered on the land has been adopted. It is based

on the assumption that fruit will always be the predominating crop in the valley. . . .

"The Willamette Valley investigations relate to no particular project in the drainage area of Willamette River, but were made to locate in a general way any projects which existing conditions might render feasible and to look into the possibilities of developing the known productive qualities of the valley soils by irrigation, either through pumping or by storing the waters of tributary streams and distributing by gravity to the lands. The lands whose irrigation possibilities were examined extend from Canby at the mouth of Molalla River to the head of Willamette River above Cottage Grove and include the area in the immediate vicinity of Portland. It was found feasible to irrigate approximately 100,000 acres at the present time. . . . The average economic duty of water which seems to be indicated for the valley as a whole is 8 in. delivered to the land, varying with local conditions of soil and crops. . . . Drainage is found to be one of the important features in connection with any proposed irrigation in the valley and must be included in any consideration of practical construction and cost."

John Day Project: Irrigation and drainage, J. T. WHISTLER and J. H. LEWIS (*Oreg. Cooper. Work, Dept. Int. U. S. Reclam. Serv., 1916, Feb., pp. 185, pls. 47*).—This report, prepared in cooperation with the State of Oregon, presents the results of investigations consisting of the following: "(1) Detailed surveys and estimates of the main project considered, which provides for the irrigation of 122,000 acres by storage of 112,000 acre feet of water at Dayville Reservoir and 133,000 acre feet at Carty Reservoir, and requires about 75 miles of supply canal diverting from John Day River 17 miles below Thirty Mile Creek. The estimated cost of this development is approximately $125 per acre. (2) Reconnoissance surveys and estimates to determine the practicability of diverting waters of the north fork of John Day River into Columbia River basin, looking toward the irrigation of Shutler Flats and any other lands which it might be found feasible to cover. . . . (3) Consideration of plans to irrigate the land within reach by pumping from Columbia River. The estimated cost of the cheapest pumping project considered is $52 per acre for 50,000 acres, with an annual charge for operation and maintenance of about $8.50."

"The lands considered in the irrigation development proposed lie along Columbia River between John Day River on the west and Umatilla River on the east, and are in Gilliam, Morrow, and Umatilla counties, Oregon. . . . The minimum run-off of record of John Day River at McDonald is 737,000 acre feet, and the average for 11 years of complete record is 1,433,000 acre feet, all of which would be available for storage. . . .

"The soils are generally of a sandy character. Of the 122,000 net acres 36 per cent is regarded as very desirable for irrigation. This soil averages from 3 to 5 ft. in depth and is underlaid with hardpan or some impervious material. Fifty-five per cent is fairly desirable for irrigation, the soil averaging from 2 to 3 ft. in depth and being generally underlaid by basalt. Nine per cent is not attractive for irrigation at the present time, the soil consisting of coarse sand with some silt to a depth of about 12 in., increasing to clean coarse sand of unknown depth. . . .

"A duty of 3 acre feet per acre has been adopted, based on the assumption that from 30 to 40 per cent of the irrigated land will be used for the growing of fruit, berries, and vegetables, and that 10 per cent will be taken up by roads and building space. Some of the land will require an amount of water greatly in excess of 3 ft., but it is believed that this amount will be found ample for the mean use when the project is fully developed."

The type of colon bacillus occurring in surface waters, L. A. Rogers (*Abs. in Jour. Bact., 1 (1916), No. 1, p. 82; Chem. Abs., 10 (1916), No. 16, p. 2115*).—A collection of 137 cultures of the colon type isolated from waters of greatly varying degrees of contamination was separated into two distinct groups. One of these included about one-third of the cultures and was evidently identical with the type which has been found to include from 95 to 99 per cent of the colon bacilli of bovine and human feces. This type was found occasionally in springs in which there was no evident source of contamination, but was especially abundant in rivers and streams usually considered to be polluted with sewage. The second group which occurred in practically all waters examined was identical with a type which, while it responds to all of the usual tests for *Bacillus coli*, occurs in feces in relatively small numbers. Cultures isolated from grains belonged almost exclusively to this type. The significance of this type in water can not be determined, but the characteristic fecal colon type can be demonstrated in polluted water with reasonable certainty.

Running water possible for every country home, R. U. Blasingame (*Ala. Polytech. Inst. Ext. Serv. Circ. 4 (1916), pp. 31, figs. 7*).—This circular describes and illustrates five water-supply systems especially adapted to Alabama farm-home conditions and varying in price from $18.50 to $126.14. "Each system has been so designed as to allow the addition of further equipment at any time funds may become available." Bills of material are also included. An arrangement whereby the water tank may be placed on a concrete or tile silo is described. "This practice is becoming rather general in Alabama, and is economical, in that it eliminates the expense of a tower."

First report of the state engineer of New Mexico, J. A. French (*Rpt. State Engin. N. Mex., 1 (1912–1914), pp. 120, pls. 15*).—This report covers the period July 12, 1912, to Dec. 1, 1914, and is divided into two main sections. One relates to the supervision of the work delegated to the State Highway Commission from the time it superseded the Territorial Road Commission, September 8, 1912, and includes the work accomplished and contemplated, with a statement of the receipts and expenditures of funds by the commission; and the other concerns the work of the state engineer, as provided by law, relating to irrigation, hydrographic surveys, power projects, pumping plants, steam gaging, Carey Act projects, irrigation districts, improvement to the Rio Grande, street paving in Santa Fe, the capitol sewer system, and well digging on state lands.

Annual report of the state engineer and surveyor of the State of New York for the fiscal year ended September 30, 1915, F. E. Williams (*Ann. Rpt. State Engin. and Surveyor N. Y., 1915, vols. 1, pp. 378, pls. 75; 2, pp. 428, pls. 10*).—This report deals with the work and expenditures of the state engineer's office for the year 1915, and reports the results of measurements of flow made on streams in the State during 1915.

Third biennial report, State Road Commission 1913–14 (*Bien. Rpt. State Road Com. Utah, 3 (1913–14), pp. 297, pls. 33, figs. 89*).—This report summarizes the engineering and other work and expenditures of the commission for the years 1913 and 1914.

[First annual report State Road Bureau West Virginia], A. D. Williams et al. (*Ann. Rpt. State Road Bur. W. Va., 1 (1914), pp. 397, pls. 25, figs. 12*).—This report for the year ended June 30, 1914, embraces tables of costs, cost data, expenditures, and assessments of counties on which road taxes have been levied, and the amount of tax raised in each of the funds by districts and by counties, also opinions of the attorney general on subjects of law pertaining to roads, orders pertaining to bonds, and a brief description of the road work being done in the State.

New road laws of Oklahoma as passed by the legislatures of 1915 and 1916 (*Oklahoma City, Okla.: The Boardman Co., 1916, pp. 80, pls. 2*).—The text of the laws is given.

Road maintenance and its significance, E. W. JAMES (*U. S. Senate, 64. Cong., 1. Sess., Doc. 429 (1916), pp. 8*).—This is an address delivered at the seventh annual convention of the Southern Commercial Congress.

The construction of roads and pavements, T. R. AGG (*New York: McGraw-Hill Book Co., 1916, pp. VII+432, pl. 1, figs. 115; rev. in Engin. Rec., 74 (1916), No. 14, p. 418*).—This book is a concise presentation of approved practice in the construction of roads and pavements and of the principles involved, and includes numerous tables and typical designs and specifications. It contains the following chapters:

The development of highway systems, surveys and plans for roads and pavements, the design of rural highways, the construction and maintenance of earth roads, testing nonbituminous road materials, sand-clay roads, gravel roads, water-bound macadam roads and pavements, concrete roads and pavements, vitrified-brick roads and pavements, wood-block pavements, stone-block pavements, bituminous road and pavement materials, dust layers and bituminous carpets, penetration and mixed macadam roads and pavements, sheet asphalt and asphaltic concrete surfaces, selection of type of surface for rural highways, selection of type of pavement surface, the design of pavements, and tests for bituminous road and paving materials.

Should wider joints be provided in concrete roads laid late in the season? H. S. VAN SCOYOC (*Engin. Rec., 74 (1916), No. 16, pp. 465, 466, figs. 2*).—The results of an inspection of 2,071 joints of ½-in. width in a concrete road built in October and November, 1915, are reported. The concrete is of 1 : 1½ : 3 mixture and the joints were spaced 35 ft. apart. It was found that in July, 1916, 94 per cent of the joints caused no perceptible jar to traffic, 4 per cent caused a noticeable jar, and 2 per cent caused a serious jar, some being raised as much as 2½ in. All joints causing a serious jar were found to be inclined from vertical. Ninety-eight per cent of the joints which heaved seriously were in sections laid later than October 15.

"It is likely that owing to the low temperature at which the concrete was laid, the unusually wet weather which prevailed during the fall of 1915, and the unusually wet and cold weather in the spring of 1916 the concrete did not set up properly. There was not the usual contraction due to the drying out of the excess water of mixing. . . . There was not sufficient space between slabs to take care of the expansion due to the increase of temperature in the early summer. . . . It would seem that, if for special reasons work must be continued late in the fall in sections with climatic conditions similar, there should be wider joints provided in the later work, as well as special precautions as to workmanship."

General specifications for concrete bridges, W. J. WATSON (*New York: McGraw-Hill Book Co., 1916, 3. ed., pp. 70, figs. 3*).—Specifications for both municipal and rural bridges are given.

Concrete and reinforced concrete, W. L. WEBB and W. H. GIBSON (*Chicago: Amer. Tech. Soc., 1916, pp. [XI]+240, figs. 123*).—This is a condensed practical treatise on the problems of reinforced concrete designs and construction, including chapters on composition and treatment, characteristics and properties of concrete mixtures, mixing and laying concrete, waterproofing concrete, preservation of steel in concrete, fire-protective qualities of concrete, steel for reinforcing concrete, general theory of flexure in reinforced concrete, practical calculation and design of beams and slabs, T-beam construction, simple footings,

compound footings, piles, retaining walls, culverts, girder bridges, concrete building blocks, fence posts, silos, concrete walks, concrete curb, concrete construction work, and flat-slab construction.

Calcium chlorid hastens seasoning of concrete (*Engin. Rec.*, *74* (*1916*), *No. 9*, *pp. 266*, *267*, *figs. 3*).—Tests conducted at the U. S. Bureau of Standards, under the supervision of R. J. Wig, of the 1:3 standard sand mortar showed that the rate of hardening was accelerated by the addition of calcium chlorid. It also increased the strength at 24 hours by from 155 to 230 per cent and at 48 hours by from 173 to 190 per cent over the strength of mortar containing no calcium chlorid. The best percentage of calcium chlorid to use for all proportions of concrete was from 3 to 4 per cent of the weight of the mixing water. The increase in strength at 48 hours thus obtained varied from 14 to 275 per cent for the 1:2:4 mix and from 11 to 110 per cent for the 1:1.5:3 mix. In all but one case the concretes mixed with 4 per cent of calcium chlorid showed a greater strength for both mixes than for plain concrete, these results being consistent, though variable, for all the ages tested up to 30 days. This acceleration in strength is believed to be due to the more complete hydration of the silicates and aluminates in the setting of the cement.

"The use of calcium chlorid increases the cost of concrete by 12 to 15 cts. per cubic yard. For best results it is important that the concrete be mixed to a quaking, but not fluid, consistency. Calcium chlorid should be used with caution for reinforced concrete construction, as it tends to accelerate any corrosion of the steel which may occur."

Tensile strength of Portland cement mortars containing lime, M. O. Fuller (*Concrete* [*Detroit, Mich.*], *9* (*1916*), *No. 3*, *pp. 89–91*, *figs. 7*).—Nine series of tests of the tensile strength of Portland cement mortars with and without hydrated lime are reported. Cement paste and 1:3 mortar of both normal and working consistencies and 1:3 mortar of working consistency containing 2:5, 5, 7.5, and 10 per cent of hydrated lime were tested after storage under water, in laboratory air, outdoors exposed to the elements, in air and water, and in moist clayey soil.

It was found that "so far as specimens stored under water or in ground are concerned, the presence of lime increases the tensile strength. As compared with the above two kinds of storage . . . a storage of test specimens in dry air shows that for 21 days mortar containing no lime developed the greater strength. After 21 days the mortars containing lime showed an increase in strength, while those containing no hydrate decreased or remained nearly constant. . . . An addition of hydrated lime up to 10 per cent of the cement not only increases very considerably the plasticity of the mortar but also increases the tensile strength."

The economical brick mortar (*Cement and Engin. News*, *28* (*1916*), *No. 9*, *pp. 192*, *193*).—Experiments conducted by J. S. Macgregor at Columbia University with seven different sets of nine piers, 8 by 8 by 84 in., constructed of hard-burned face bricks and common bricks bound with cement mortars of different proportions and containing varying amounts of hydrated lime, are reported, the purpose being to determine to what extent hydrated lime may replace cement in the mortar without reducing the factor of safety under practical conditions. The results are shown in the following table:

Crushing tests of cemented brick piers.

Mixtures used—proportions by volume.			Crushed after 7 days.	Crushed after 28 days.	Crushed after 3 months.
Cement.	Sand.	Hydrated lime.	Crushing strength per square inch.	Crushing strength per square inch.	Crushing strength per square inch.
			Pounds.	*Pounds.*	*Pounds.*
1.00	3	....	2,630	2,840	2,840
.90	3	0.10	3,080	3,170	4,435
.85	3	.15	2,890	3,230	4,300
.75	3	.25	3,120	3,470	4,170
.50	3	.50	2,760	3,100	3,820
.25	3	.75	1,945	2,370	2,720
....	3	1.00	1,535	1,870	1,915

"The results of this investigation unquestionably determine that hydrated lime has a greater value in brick masonry than it is generally given credit for having." "Assuming the market price of Portland cement and hydrated lime to be the same, pound for pound, specifications calling for mortar to be composed of 50 lbs. of Portland cement, 20 lbs. of hydrated lime, and 300 lbs. of sand (approximately 0.5 cu. ft. Portland cement, 0.5 cu. ft. hydrated lime, and 3 cu. ft. of sand) will not only give a much higher structural value, but will also make a saving of 30 cts. on every dollar spent for the cementing mixture in brick mortars."

Handbook of practical smithing and forging, T. MOORE (*New York: Spon & Chamberlain, 1914, pp. [VI]+248, figs. 401*).—This is a practical treatise on the arts of smithing and forging, in which the author first deals with forges, hearths, hammers, forging machines, presses, iron and steel, and testing, and then devotes considerable space to a description and discussion of practice in general forging and smithing, including a summary and explanation of technical terms, expressions, and phrases. Tables of handy data are appended.

Gas-engine principles, R. B. WHITMAN (*New York and London: D. Appleton & Co., 1915, pp. XV+248, figs. 74*).—This is a semitechnical treatise on the handling, care and maintenance of small stationary gas engines and contains the following chapters: Gas-engine principles; engine types; engine parts; valves and valve mechanism; carburetion; ignition and electrical principles; electric generators; make-and-break systems; jump spark ignition system; lubrication and cooling; power, care, and maintenance; causes of trouble; effects of trouble; and testing for trouble.

Tractor engines, W. J. MCVICKER (*Gas Engine, 18 (1916), No. 7, pp. 333–336*).—In considering the requirements necessary to meet the conditions in power farming, it is pointed out that a successful tractor engine must have the following qualifications regardless of its type:

"It must be so constructed that it can develop its maximum horsepower continuously without self-destruction. The elements of limited overload must be eliminated because it can not be controlled. It must start and operate without undue loss of time and must do a season's work with ordinary care and without the services of an expert. . . . It must develop its rated power economically, and operate successfully with the kinds of fuel common in the locality where it is to be used."

A novel cooler for internal combustion engines (*Sci. Amer. Sup., 82 (1916), No. 2123, p. 165, figs. 2*).—A cooler designed for the efficient and rapid trans-

ference of heat between two fluids, one of which (air) is in the gaseous and the other in the liquid state, is described and illustrated.

"The liquid to be cooled is contained in a tank in which a number of cooling cylinders revolve. These cylinders are built of galvanized steel sheeting wound in the form of a spiral, the whole forming an enormous cooling surface in a very small space. The lower portion of the cylinders dips in the tank containing the liquid to be cooled and air is passed through the annular spaces of the upper half."

Carburetion. E. E. Dean (*Gas Engine, 18 (1916), No. 7, pp. 340–348, fig. 1*).—It is pointed out in this report that in order to burn kerosene or lower grade distillates efficiently a carbureter is necessary which is capable of "delivering to the manifold, a thoroughly saturated charge, having the correct air-fuel ratio for all velocities, [and a] manifold capable of transporting this charge without change of mixture proportions and delivering it to the combustion space.

"To overcome the temperature losses due to vaporization and expansion, and assist atomization and vaporization, we must increase the temperature of the intake air. To prevent deposition of the fuel molecules, along the sides and bottom of passages, resulting in an impoverished mixture, we must apply heat to these surfaces.

"It is advisable to apply a limited amount of heat to the fuel supply to raise its temperature slightly above its vaporization point."

Official tests of mechanical cultivation (*Jour. Agr. Prat., n. ser., 29 (1916), No. 17, pp. 300, 301*).—Plowing tests in light soil of a 4-wheeled tractor with a 4-cylinder engine are reported. The weight of the tractor was about 6,650 kg., of which about 2,000 kg. was on the front wheels.

When plowing a furrow 15 cm. deep and 2.42 meters wide at a speed of 3,240 meters per hour, it was found that 4,902 square meters were plowed per hour with a fuel consumption per hour of 10.74 kg. and per hectare of 21.9 kg. When plowing a furrow 17.6 cm. deep and 2.4 meters wide at a speed of 3,132 meters per hour, it was found that 4,784 square meters were plowed per hour with a fuel consumption per hour of 13.2 kg. and per hectare of 27.5 kg.

Modern piggery buildings. H. W. Potts and A. Brooks (*Agr. Gaz. N. S. Wales, 27 (1916), No. 8, pp. 555–560, pl. 1, figs. 6*).—Plans and details of a building especially constructed for the housing of pedigreed stock, with boar sties on one side of the passage only, are presented.

The construction of silos. A. M. Kuijsten (*Cultura, 28 (1916), No. 336, pp. 285–294, pls. 8*).—Dutch practice in silo construction is described and illustrated.

RURAL ECONOMICS.

The country town. W. L. Anderson (*New York: Doubleday, Page & Co., 1914, pp. III+307*).—This book endeavors to set forth the rural changes in their historical, scientific, and social aspects. The author concludes that there is no scientific reason for the popular notion that the rural population is under a fatality of evil. Its future is thought to depend almost wholly upon the power of environment, education, commerce, and evangelization, and upon participation in the great movements of the age.

The social survey: A bibliography, compiled by Z. L. Potter (*New York: Russell Sage Foundation, 1915, pp. 16*).—Among the topics included in this bibliography relating to rural conditions are the purpose and method of rural surveys, rural survey reports, and special reports regarding rural health and schools.

Proceedings of the thirty-fifth annual session of the Farmers' National Congress of the United States (*Farmers' Nat. Cong. U. S., Proc., 35 (1915), pp. 209+[4], figs. 3*).—The addresses before the congress dealt principally with

rural organizations and cooperation, rural credit, social life on the farm, and allied topics.

Value to farm families of food, fuel, and use of house, W. C. FUNK (*U. S. Dept. Agr. Bul. 410* (*1916*), *pp. 35, figs. 3*).—The data given in this bulletin was obtained from 14 different areas in as many States and were selected as more or less typical of conditions in those States.

The results indicate that the average value of food, fuel, and use of house was $642, of which $424 was furnished by the farm. The average value of the food per family was $448, and consisted of 58 per cent animal products, 25 per cent groceries, 11 per cent vegetables, and 6 per cent fruits. Of the total amount, 58 per cent was furnished by the farm. The average value of the fuel was $62, wood comprising $36.30, coal $17.85, and oil $6.33, and 54 per cent was obtained from the farm. The average value of the use of the house was $132. The annual value of the housework was estimated at $228, 95 per cent of which was furnished by the family.

It was found that the average value of meats (other than poultry) consumed on the farm was $107.25, of poultry products, $55.40, and of dairy products, $98.36. Families living on their own farms reported a higher consumption of food and a larger proportion of food derived directly from the farm than did those living on rented farms. The cost of board (as of hired hands) in food, fuel, and housework was shown to be $129 per year. Thirty-one per cent of this represented cash outlay.

Losses from selling cotton in the seed, C. F. CRESWELL (*U. S. Dept. Agr. Farmers' Bul. 775* (*1916*), *pp. 8*).—The author discusses the question on the basis of interviews with farmers, ginners, oil-mill men, and others, and on the study of seed-cotton marketing previously noted (E. S. R., 35, p. 793). A series of tables are included, showing the prices of lint cotton, calculated from certain seed-cotton prices and certain lint percentages.

The elevator movement in the Pacific Northwest, H. T. LEWIS (*Jour. Polit. Econ., 24* (*1916*), *No. 8, pp. 794–804*).—The author discusses the practice of shipping grain in bulk or in sacks, and the effects upon the methods of farming and grain distribution.

Report of the Bureau of Markets, 1915 (*Rpt. Bur. Markets* [*Newton, Mass.*], *1915, pp. 36, pls. 2, figs. 10*).—This report gives a brief history of the efforts of the city of Newton, Mass., to establish a local market and the results of three months' operations.

The Federal Farm Loan Act, W. B. PALMER (*Quart. Pubs. Amer. Statis. Assoc., n. ser., 15* (*1916*), *No. 115, pp. 292–312*).—The author gives a brief history of the circumstances leading up to the passage of this act and outlines its provisions. See also an editorial note (E. S. R., 35, p. 101).

The farm loan primer (*U. S. Treas. Dept., Fed. Farm Loan Bd. Circ. 5* (*1916*), *pp. 11*).—This circular contains a series of questions which have been most frequently asked about the Federal Farm Loan Act, and answers prepared by members of the board.

National farm loan associations (*U. S. Treas. Dept., Fed. Farm Loan Bur. Circ. 1* (*1916*), *pp. 4*).—In this circular are briefly explained the organization, management, powers, and limitations of the local loan association.

How farmers may form a national farm loan association (*U. S. Treas. Dept., Fed. Farm Loan Bur. Circ. 2* (*1916*), *pp. 8*).—This circular indicates the various steps necessary in forming an association to borrow money under the provisions of the Farm Loan Act.

The North Carolina credit union, W. R. CAMP (*N. C. Agr. Ext. Serv. Circ. 13* (*1916*), *pp. 11*).—This circular contains a brief statement as to the purpose of the credit union and methods of organization.

Report on the working of cooperative societies in Bihar and Orissa for the year 1914–15 (*Rpt. Work Coop. Soc. Bihar and Orissa, 1914–15, pp. 33+XII+4*).—This report gives a brief statement of the work of the different rural credit, agricultural, and nonagricultural organizations, as well as data as to the membership, receipts, disbursements, and capital of the different societies.

The supply of agricultural implements by cooperative societies, B. C. Burt (*Agr. Jour. India, 11* (*1916*), *No. 2, pp. 205–209, inc.*).—This article describes the experience of cooperative societies in India in purchasing implements to be rented to members of the organization.

Cattle insurance societies, A. C. Chatterjee (*Agr. Jour. India, 11* (*1916*), *No. 2, pp. 108–111*).—This article contains a brief description of methods used in insuring animals purchased by loans from the agricultural primary societies in India.

Final report of the departmental committee appointed by the president of the Board of Agriculture and Fisheries to consider the settlement and employment on the land in England and Wales of discharged sailors and soldiers (*Final Rpt. Dept. Com. Land Settlement Sailors and Soldiers* [*London*], *1916*), *pt. 2, pp. 39*).—This report discusses the number of men withdrawn from agriculture to join the army, and methods to be used at the close of the war to attract men into agricultural occupations. This volume contains both the majority and minority reports.

Farming and food supplies in time of war, R. H. Rew (*Rpt. Brit. Assoc. Adv. Sci., 85* (*1915*), *pp. 760–769*).—The author discusses the influence of home production and the relative proportion of the different products obtained by importation, also the changes which have taken place under war conditions.

Our food supply, C. Turnor (*London and New York: C. Scribner's Sons, 1916, pp. IX+171*).—The author discusses the food supply in England and subjects relating thereto under the following heads: Present and suggested sources of food supply; present agricultural methods; new and improved methods; the laborer; small holdings; land settlement for ex-service men; education; and agricultural credit.

[Report of the German food supplies committee] (*Better Business, 1* (*1915*), *No. 1, pp. 51–70*).—This article describes the functions of the committee in dealing with the production and distribution of agricultural products under war conditions.

Vacant public lands on July 1, 1915, and July 1, 1916 (*U. S. Dept. Int., Gen. Land Off. Circs. 420* (*1915*), *pp. 24; 484* (*1916*), *pp. 24*).—These reports continue the information previously noted (E. S. R., 32, p. 390) and correct the data up to July 1, 1916.

Circular instructions relating to acquisition of title to public lands in the Territory of Alaska, compiled by C. Tallman (*U. S. Dept. Int., Gen. Land Off. Circ. 491* (*1916*), *pp. 89*).—This circular contains a compilation of laws and regulations governing the acquisition of title to public lands in Alaska.

Vermont farms (*Essex Junction, Vt.: Vt. Bur. Pub.* [*1915*], *pp. 140, figs. 16*).—This report contains a detailed statement of facts and figures concerning the agricultural resources and opportunities of the State.

Twenty-first biennial report of the Bureau of Agriculture, Labor, and Statistics of Kentucky (*Bien. Rpt. Bur. Agr., Labor, and Statis. Ky., 21* (*1914–15*), *pp. 530, pls. 32*).—This report contains a statement showing for each county in the State the population, assessed acreage, value of land and improvement, and a brief description of agricultural land and the type of agriculture practiced, and outlines the activities of the various branches of the bureau.

[Agriculture in Hawaii], (*Rpt. Gov. Hawaii, 1914, pp. 9–12, 26–30, 39–42, 47–51, 53–57*).—The subjects treated are the land problem, transportation, land settlement, the work of the Bureau of Agriculture and Fisheries, and agricultural education.

Grain statistics of Canada, 1914–15, R. MAGILL, W. D. STAPLES, and J. P. JONES (*Canada Ann. Rpt. Dept. Trade and Com., pt. 5 (1916), pp. VII+320, pls. 5*).—In this report is contained the report of the grain commissioners showing the amount of grain handled by the various Canadian elevators, daily, monthly, and yearly prices, and the activities of the different branches of the board in connection with the licensing of elevators and the inspection of the grain and elevators.

[Agricultural statistics of São Paulo] (*Bol. Dir. Indus. e Com. São Paulo, 7. ser., No. 6 (1916), pp. 235–278*).—This report gives data showing the area, production, and trade of the principal agricultural products.

Production and trade in agricultural products of Great Britain and Ireland, 1915, J. J. L. VAN RIJN (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. en Meded. Dir. Landb., No. 1 (1916), pp. 106–157, figs. 3*).—In this report is discussed the relative importance of the home production and the imported agricultural products, and the sources of agricultural imports and prices.

Fourth report of the board of agriculture for Scotland, R. P. WRIGHT ET AL. (*Rpt. Bd. Agr. Scot. 4 (1915), pp. 59*).—In this report is reviewed the work of the board during the past year. It treats principally of the progress in land settlement, agricultural education and research, and the agricultural problems due to the war.

[Agricultural production in Austria, 1915] (*Anbauflächen und Ernteergebnisse in Österreich im Jahre 1915. Vienna: K. K. Ackerbauministerium 1916, pp. 55*).—This report gives the area, production, and average yield of the principal crops in Austria and by minor subdivisions for 1915, with comparative data for earlier years.

The recent development of German agriculture, T. H. MIDDLETON (*Abs. in Jour. Bd. Agr. [London], 23 (1916), No. 5, pp. 426–430*).—In this article is given a synopsis comparing the efficiency of agricultural methods in England and Germany, and pointing out the differences in the results obtained.

Agricultural statistics of British India, 1913–14, G. F. SHIRRAS (*Agr. Statis. India, 30 (1913–14), I, pp. X+415, pls. 5*).—This report continues the information previously noted (E. S. R., 34, p. 92) by adding data for the crop year of 1913–14.

AGRICULTURAL EDUCATION.

Agricultural and industrial education, consolidation of schools, training and supply of teachers, courses of study, physical and moral education, with recommendations (*Rpt. Saskatchewan Ed. Com., 1915, pp. 208*).—Part one of this report of the Saskatchewan Educational Commission, which was appointed May 9, 1912, contains (1) a report on the present status of agricultural education in Saskatchewan; accounts of what is being done in agricultural instruction in Alberta, Manitoba, Ontario, Michigan, Massachusetts, Wisconsin, England, Scotland, France, and Belgium, including a summary of legislation in eight States; and descriptions of typical agricultural schools in the United States and Australia; and (2) a similar account of the present status of industrial education, including instruction in home economics. A bibliography on agricultural and industrial education, etc., is among the data appended.

The commission recommends that in Saskatchewan agricultural and industrial education be amplified and extended by the use of existing agencies, viz, the public, high, and normal schools, and the university, including the agricultural college. It advocates (1) systematic efforts to introduce nature study, school gardening, manual training, and elementary household science more generally into the public schools and to provide in the more advanced schools instruction and training for the preparation of teachers and leaders in these departments; (2) short courses in agriculture and elementary science during vacation periods, where necessary, to be given in rural schools by traveling expert instructors; (3) the establishment of industrial evening schools in villages and towns; (4) provision in high schools for short winter courses in agriculture and instruction in advanced manual training and household science and such specialized form of industrial work as may be deemed advisable; (5) initial and annual grants and expert direction for work in public and high schools in school gardening and agriculture, household science, manual training, and related branches; (6) increased facilities for instruction in school gardening and elementary agriculture, manual training, and elementary household science in the provincial normal schools; (7) the establishment in the university of a school of domestic science and a college of technology for a corresponding development of industrial education; (8) the acceptance of either agriculture or household science in lieu of physics or chemistry in the examinations for third and second class teachers' diplomas and in the university at the junior matriculation examination; and (9) the appointment of expert district representatives to assist the department and college of agriculture in promoting the welfare of rural communities.

Part two deals with the supply and training of teachers, courses of study, textbooks in Saskatchewan, and the consolidation of schools in the United States.

Agricultural education in New South Wales, T. E. Sedgwick (*Jour. Bath and West and South Counties Soc., 5. ser., 10 (1915–16), pp. 77–86*).—An account is given of the system of agricultural instruction in New South Wales, which affords an uninterrupted opportunity for students to pass successively through the primary school, the Hurlstone Agricultural High School, the experimental farm and school, the Hawkesbury Agricultural College, and the university, where the degree of B. S. in Agriculture is awarded, thus qualifying for a Government inspectorship or other appointment.

Agricultural education in the State of Victoria, Australia, C. K. Harrison (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 1154–1156*).—This is a summarized statement of agricultural teaching in the primary state schools, technical schools, agricultural colleges and experimental farms, and extension teaching.

Gardening and farming in the Philippine schools, N. H. Foreman (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 1156–1159*).—The following phases of agricultural instruction in the Philippine schools are briefly described: School gardening, special food campaigns, settlement farm schools, farm schools, and agricultural schools.

The development of the Philippine public-school system in cooperation with the home and in relation to industrial conditions, H. H. Miller (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 1116–1121*).—The growth of the system, the courses of study and their aim, including school gardening, farming, housekeeping, and household arts, and how the homes are reached, are discussed.

Rural science and school gardening, W. H. Johns (*Dept. Agr. and Tech. Instr. Ireland Jour., 16 (1916), No. 3, pp. 441–454, pls. 4*).—The author dis-

cusses the reasons for adopting instruction in school gardening in public elementary and other schools in Ireland, the correlation of school gardening with other subjects, the training of teachers of school gardening, schemes of instruction, the plan of a typical garden, managing and cropping gardens, site and equipment, operations, etc. The syllabus in rural science, including school gardening, for the training of national school teachers at the Royal College of Science for Ireland, Dublin, and in classes at approved centers in a few selected counties is given.

The author states that "perhaps the main distinction between the various British and Irish schemes of school gardening lies in the fact that in Great Britain the subject is regarded mainly as a practical or handicraft subject, whereas in Ireland the Department [of Agriculture and Technical Instruction], while insisting upon the practical side, has sought to coordinate it with the teaching of elementary practical science with the view to making it truly educational." The general beginning of school garden work in Ireland dates from 1910, when the department's present scheme of rural science and school gardening was introduced. At present there are 150 schools in which the subject is taught by specially trained teachers. The schemes of instruction for the training of both teachers and pupils in national schools are very similar, and the subject may be said to center around the life study of a typical garden plant. Teachers of this subject in Ireland may earn small special grants as well as prizes.

High-school extension in agriculture, C. H. LANE (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 1132–1136*).—The author includes under high school extension work in agriculture "all educational efforts at the homes and on the farms of the people, and also such work at the school itself as is more or less temporary and that centers directly in interests away from the school." He discusses when and how such work should be undertaken by high schools and the training of teachers for extension work.

Courses for training teachers should contain two essential elements, viz, sound training in the science of agriculture and sound experience in the practice of the art. It is deemed extremely doubtful whether the student training to become a high-school instructor in agricultural extension work "should be permitted to specialize in the latter part of a course as is now common in larger institutions. On the contrary, since he is to be a teacher, it is necessary for him to have training in psychology and in the principles and methods of education." He should give careful attention to language work and have much practice in the clear and simple statement of his thoughts and in public speaking, and inasmuch as he is to promote successfully farm practice, stress should be laid on instruction in farm management, rural economies, and rural sociology. Provision should also be made for actual practice in extension work in the junior and senior years.

The ways suggested for the teacher of agriculture to extend his influence outside of his regular high-school work include the supervision of the home-project work of his pupils, the directing of agricultural instruction in the grades, the organizing and following up of boys' and girls' clubs, the acting as organizer for the one week's short course for farmers, the offering of personal counsel and advice on certain days to farmers of the community, assisting in organizing farmers' reading courses, directing school agricultural exhibits locally and at the county fair, and through Saturday meetings with farmers and by farm visitation.

School credit for boys' and girls' club work and extension activities in agriculture and home economics, O. H. BENSON (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 1144–1153*).—The author discusses boys' and girls' club

work as it is related to the public school and its claim upon the school from the standpoint of school credit. While he considers "the education, experience, health, and conservation value, together with the blessings of the out of doors and a net profit on investment," the best possible credit that may be received from club work, so far as the boys and girls are concerned, he believes it will be worth while for the school to express itself in a tangible way in connection with this work for the benefit of the school and the school curriculum. It is recommended that all of the bases of awards used in club home projects be also used as the bases of awards for the giving of school credits. A list of projects, specific requirements, and standards for awarding school credit for each project are given.

How boys and girls respond to home work in a large city, C. F. PALMER (*Addresses and Proc. Nat. Ed. Assoc., 53 (1915), pp. 1139–1143*).—An account is given of home gardening in Los Angeles and its good effects.

Girls' and boys' club work: A manual for rural teachers, MARY E. CRESWELL (*Bul. Ga. State Col. Agr., No. 101 (1916), pp. 52, figs. 5*).—In this bulletin the following subjects are discussed: School Values in Boys' and Girls' Club Work, by H. W. Odum; Relating Boys' and Girls' Club Work with that of the Public Schools and Seasonal Activities, by Mrs. Bessie S. Wood; Correlation of Agriculture and Home Economics with Common-school Subjects in Georgia, and Arithmetic Problems Based on Germination of Seed Corn, by Miss C. S. Parrish; Purpose of Boys' Corn Clubs, by J. K. Giles; Boys' and Girls' Poultry Clubs, by D. J. Taylor; Boys' Pig Clubs in Georgia, by J. E. Downing; Some Typical Programs for Meetings, by Miss Nola Johnson; and Historical Development, Keeping Records, Lessons Connected with Canning, etc., by the author. A brief list of references is included.

MISCELLANEOUS.

Twenty-second Annual Report of Montana Station, 1915 (*Montana Sta. Rpt. 1915, pp. 221–263*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1915, and a report of the director on the work and publications of the station. The experimental work reported is for the most part abstracted elsewhere in this issue.

Twenty-eighth Annual Report of Vermont Station, 1915 (*Vermont Sta. Rpt. 1915, pp. XXIII+462+4, pls. 32, figs. 105*).—This contains the organization list, a brief announcement concerning the station, a financial statement for the fiscal year ended June 30, 1915, a report of the director on the publications and work of the station, and reprints of Bulletins 184–190, previously noted, and of Circular 9, noted below.

Publications for free distribution (*Vermont Sta. Circ. 9 (1915), pp. 4*).—The publications available for distribution are listed.

List of available publications (*West Virginia Sta. Circ. 23 (1916), pp. 4*).—The station bulletins and circulars and the extension department publications available for distribution are listed.

NOTES.

Hawaii College.—Jared G. Smith, professor of agriculture, has resigned to become manager for a large commercial tobacco growing company on the island of Oahu, and has been succeeded by L. A. Henke, previously director of agriculture at the high school of Elbow Lake, Minnesota.

Maryland College and Station.—Dr. A. F. Woods, dean of the Minnesota College and School of Agriculture and director of the Minnesota Station, has been appointed president of the college beginning July 1. Dr. H. J. Patterson, the retiring president, will continue as director of the station. Dr. Raymond C. Reed, professor of bacteriology, hygiene, and veterinary science at the Delaware College and animal pathologist of the Delaware Station, has been appointed chief of the department of animal industry.

Capt. Richard W. Silvester, president of the college from 1892 to 1913 and subsequently president emeritus and librarian, died December 31, 1916, at the age of 59 years.

Massachusetts College and Station.—Additional appropriations aggregating $488,200 have been requested from the State Legislature. Of this amount $250,000 is for a library building, $90,000 for extensions to the power plant, $85,000 for other equipment and improvements, $50,000 for a dormitory, $9,000 for rural engineering shops, and $4,200 for a poultry house and judging laboratory. In addition $35,000 is requested to improve, equip for experimental work, and maintain for two years the tract of land acquired at Lexington, under a previous appropriation of $8,000, for use as a market garden field station under the management of the college.

A. B. Beaumont, assistant professor of soil technology in Cornell University, has been appointed associate professor of agronomy and acting head of the department. E. D. Waid, assistant director of the extension service, has resigned to engage in farming. In the station Dr. A. C. Edwards, assistant in veterinary science, resigned December 31, 1916. S. H. DeVault has been appointed graduate assistant in agricultural economics.

New Hampshire College.—Pres. E. T. Fairchild died at Durham, N. H., January 23, at the age of 62 years. President Fairchild was a native of Ohio, for 10 years a regent of the Kansas College, and from 1907 to 1912 State superintendent of public instruction in Kansas. He had been president of the New Hampshire College since 1912, during which time the enrollment and equipment of the institution had been largely increased. He was widely known in educational circles, and served as president of the National Education Association in 1912.

North Carolina College and Station.—Some interesting results are reported by the division of horticulture from work with pecans in the eastern part of the State. A large part of the old trees have been renewed by top-working, etc., with varieties such as Stuart and Schley, which have been found to be the best adapted for the purpose.

B. P. Folk, State agent in charge of pig club work, resigned January 1 to engage in farming in Louisiana. In the division of agricultural clubs A. K.

Robertson, assistant in corn club work, has been promoted to agent in corn club work.

South Carolina Station.—The division of entomology has completed an elaborate apparatus for the control of temperature and moisture. The principle consists of pumping air through an ice chamber and expanding it by heat in a second chamber to acquire the desired humidity. The temperature of individual insects is recorded by means of an electric thermocouple.

The division has also completed its field laboratory for entomological study. This building is equipped with the necessary thermographs for air and soil temperatures and other apparatus.

Vermont University and Station.—A. F. Hawes, professor of forestry and State forester, has resigned to take effect February 15, to become extension specialist in forestry in the Office of Extension Work in the North and West of the States Relations Service of the U. S. Department of Agriculture. W. C. Stone, assistant horticulturist in the station, has accepted a similar appointment in the New York State Station, and has been succeeded by John B. Norton, a 1914 graduate of the Massachusetts College.

Washington College.—The State legislature of 1915 appointed an educational commission of three senators and three representatives to make a survey of the educational situation in the State, and specifically of the State college, the State university, and the three normal schools. This commission subsequently secured the services of the United States Bureau of Education in making a survey, the results of which were recently published. The recommendations in this report were embodied in a bill presented to the legislature, in which provision was made for the transference of several departments and all graduate work in engineering and pure science from the college to the university.

This measure failed of passage, and in its stead a law was enacted defining the fields of work of the two institutions. This law provides that the courses of instruction at the university shall embrace, as exclusive major lines, law, architecture, forestry, commerce, journalism, library economy, marine and aeronautic engineering, and fisheries, as well as instruction in medicine. Those of the State college are to embrace, as exclusive major lines, agriculture in all its branches and subdivisions, veterinary medicine, and economic science in its applications to agriculture and rural life. Both the university and the State college are to offer as major lines courses in the liberal arts, pure science, pharmacy, mining, civil engineering, electrical engineering, mechanical engineering, chemical engineering, home economics, and the professional training of high school teachers, school supervisors, and school superintendents.

The law further provides for a joint board of higher curricula of nine members chosen from the presidents and regents of the five State institutions of higher learning. In the future all major lines of work taken up by any of these institutions must first be approved by a two-thirds vote of this board.

A second act was passed granting in perpetuity to the State college all Federal land hitherto allotted to the State for a scientific school, and also definitely allotting to the same institution all Federal funds granted under the Morrill Act and all legisation supplementary thereto.

States Relations Service.—Dr. E. V. Wilcox, administrative assistant in the Office of Experiment Stations, has been transferred to the Office of Farm Management of the U. S. Department of Agriculture, where he is to carry on studies of systems of land tenure, and has entered upon his duties.

Dominion Experimental Farms.—Tracts of timber land are being cleared and prepared, mainly through the labor of interned aliens, at Kapuskasing in northern Ontario and Spirit Lake in northern Quebec for eventual use as sub-

stations. The site in Ontario comprises about 1,000 acres in the township of O'Brien, where a considerable area has been cleared, drainage begun, and about 125 acres of field crops grown. A horse barn has been nearly completed and a cattle barn is under way.

The Quebec tract is situated in the townships of Trecesson and Dalquier, and is expected to comprise about 1,600 acres. Not all of this tract is arable, but about 150 acres of field crops have already been grown. Considerable clearing and draining have been done and a small greenhouse has been erected. Smith Ballantyne has been appointed foreman manager at Kapuskasing and Pascal Fortier at Spirit Lake. Considerable difficulty is reported in getting the prisoners to work, and it is not expected to carry on much experimental work under the present conditions. It is, however, hoped to accomplish a good deal in the preparatory operations of clearing, breaking, and draining the land, and thus have as much as possible ready when experiments can be begun.

Society for the Promotion of Agricultural Science.—The thirty-seventh annual meeting of this society was held at Washington, D. C., November 13 and 14, 1916.

The presidential address was given by Director C. E. Thorne of Ohio, at a joint session of the society with the American Farm Management Association and the American Society of Agronomy. In this paper Director Thorne reviewed the history and development of the society and discussed its opportunities for future service. As among these, he suggested the desirability of considering the federating of the various organizations of workers in agricultural science. This proposition subsequently received considerable discussion at the business meeting of the society, at which a plan of reorganization was submitted by Director C. D. Woods of Maine. A poll of the entire membership of the society was eventually decided upon.

The papers read and discussed were as follows: Improving Grasses by Selections, by W. J. Beal; The Mineral Metabolism of the Milch Cow, by E. B. Forbes; Agricultural Grasses, by C. V. Piper; Boys' and Girls' Club Work in Relation to Agricultural Education, by W. D. Hurd; The Physiological Requirements of Wheat and Soy Beans Growing in Sand Media, by A. G. McCall; The Factors Determining Quality in Milling Wheats, by J. S. Jones; Observations on Meadow Insects, by Herbert Osborn; Varying Effects of Salt on Different Plant Families, by S. M. Tracy; Forest Depredations and Utilization, by F. W. Rane; The Straw Mulch in Orchard Management, by C. B. Lipman; and The Farmer's Knowledge of the Details of his Business, by W. J. Spillman.

The election of officers for the ensuing year resulted as follows: President, Herbert Osborn; vice-president, W. P. Brooks; secretary-treasurer, C. P. Gillette; custodian, W. D. Hurd; and member of the executive committee, W. R. Dodson.

American Farm Management Association.—The seventh annual meeting of this association was held at Washington, D. C., November 13 and 14, 1916.

In the absence of the president, Director H. A. Morgan of Tennessee, the annual address was given by the vice-president, H. W. Jeffers of Plainsbury, N. J., upon the subject of How the Investigator of Farm Management Problems Can Help the Farmer. Mr. Jeffers drew attention to the changing conditions of modern life, and stated that despite the advancement in the technique of agriculture, this calling has been among the slowest to respond to modern methods as regards efficiency. Farmers, however, are beginning to analyze their business, and from this standpoint need assistance especially in bringing about the standardization of the farm organization and the farm enter-

prise. Regional studies of farm practice and studies of the efficient use of farm machinery were also cited as desirable.

Assistant Secretary of Agriculture Vrooman addressed the association, expressing his special interest in the kind of work which it represented. He pointed out that if there is to be a permanent agriculture, farm operations must be made profitable and that farming, which too often has been merely an occupation, must become a business. The individual farmer, in his view, ought no more to be expected to be an expert in farm management than in chemistry, plant diseases, or the like, but should receive the benefits of those trained to correlate the many complex factors with which he is called upon to deal.

The program also included the following papers: Farm Management Extension, by S. B. Cleland and E. A. Brown; The Farmer as a Social Institution, by E. A. Goldenweiser; Climatic Factors in Relation to Farm Management Practice, by J. Warren Smith; Relation of Agronomy to Farm Management, by C. V. Piper; The Poor Man on Poor Land, by J. S. Cates; Adequate and Economic Farm Buildings, by J. H. Hankinson; Consideration of a Simple Method of Determining the Relative Profitableness of Different Farm Enterprises, by D. H. Otis and R. V. Gunn; Cost Accounting on Farms, by G. F. Warren; and Farm Management Problems in Horticulture, by L. C. Corbett.

Reports were received from several committees of the association. The report on farm management investigations, R. L. Adams, chairman, summarized the work under way in the U. S. Department of Agriculture and the agricultural colleges and experiment stations. No work was reported from sixteen institutions, but that of the remainder showed a considerable scope and variety. The report of the committee on extension work, L. H. Goddard, chairman, dealt especially with the collection of farm analysis records and the relations to be observed with the county agents and farm bureaus in carrying on work of this sort. The status of farm management teaching was reviewed in the report of the committee on that subject, of which O. R. Johnson was chairman.

Definitions for the terms "farm management," "animal unit," "family labor," "labor income," "family labor income," "family income," "paid labor," "crop index," "dairy farm," "general farm," "man work unit," and "horse work unit" were proposed by the committee on standardization of nomenclature. These definitions were tentatively adopted by the association, final action being deferred until the next meeting.

An amendment to the constitution providing a third standing committee on farm management extension was adopted. The executive committee was instructed to confer with representatives of other societies with reference to the joint publication of a journal.

Officers for the ensuing year were elected as follows: President, H. W. Jeffers; vice-president, F. W. Peck; and secretary-treasurer, G. A. Billings.

Association of Official Agricultural Chemists.—The thirty-third annual convention of the association was held November 20–22, 1916, at Washington, D. C., with a registration somewhat larger than that of the previous year. Assistant Secretary of Agriculture Vrooman welcomed the members of the association to Washington, and pointed out the important relation existing between the chemist and the people, and also the dependence of the people on the accurate, definite scientific knowledge developed by the chemist.

The annual address of the president of the association, Dr. R. N. Brackett, reviewed the history of the association from its beginning. He traced its influence on the development of other chemical organizations and activities, the establishment of food and drug standards, and the development of methods for the control of various products, related either directly or indirectly to

agriculture, and drew attention to the many opportunities for constructive work still available.

The honorary president, Dr. H. W. Wiley, also addressed the convention and spoke of the development of various branches of chemistry which he had been privileged to observe. He pointed out the dependence of the public health and welfare on the work of the chemist, and maintained that the important service rendered justified adequate recognition by the people.

The usual reports of the referees and associate referees were read and discussed, and, following reports from the committees on recommendations of referees, were accepted. It is expected that these reports will be published in full in the *Journal* of the association at an early date.

Dr. C. B. Lipman pointed out that many methods at present used for soil analysis are of little value, while there are many methods used by soil chemists throughout the country which yield excellent results but are not considered official. He emphasized the necessity of gathering, studying, and revising these various methods so as to produce, if possible, a uniform set of accurate procedures for soil analysis. A special soil analysis committee composed of the referee (Dr. Lipman), the associate referee (W. H. McIntire), and E. C. Shorey, A. W. Blair, and Robert Stewart, was appointed to consider these matters.

A committee was also appointed to study and consider the subject of the sampling of fertilizers, to cooperate with a like committee from the fertilizer section of the American Chemical Society. This committee consists of C. H. Jones, W. J. Jones, jr., and B. F. Robertson.

The report of the committee on editing methods of analysis was accepted, and the committee continued and authorized to incorporate such further changes in the methods as have been or might be recommended by the association. The committee expressed the hope that it would soon be able to publish the newly revised methods in compact and convenient form.

A recommendation from the executive committee for a new classification of subjects for the referees and associate referees was accepted. The new classification is considered more uniform and consistent than its predecessor. Several minor changes were also made in the constitution and by-laws.

The secretary reported that the *Journal* of the association had removed its financial deficit, and that its permanency seemed established. The number of foreign subscriptions was deemed especially gratifying, indicating the widespread appreciation of the value of the publication. A vacancy on the board of editors, caused by the expiration of the term of Dr. L. L. Van Slyke, was filled by his reappointment.

The following special papers were read at the meeting: The Inosit Phosphoric Acid of Cotton-Seed Meal, by J. B. Rather; The Titration of Grain Extracts in the Presence of Alcohol, and A Simple Method for Measuring the Acidity of Cereal Products and Its Application to Sulphured and Unsulphured Oats, by V. Birckner; Origin of the Neutralization Precipitate of Cow's Milk, by L. S. Palmer; The Separation and Gravimetric Estimation of Potassium, by S. B. Kuzirian; A New Rapid and Accurate Method for Estimating Lime and Potash in Soils, by T. E. Keitt and C. J. King; The Occurrence and Determination of As^{V} and As^{III} in the Presence of Each Other in Arsenical Insecticides, by R. C. Roark; The Relation of the Lime Requirement of Soils to Their Retention of Ammonia, by L. P. Howard; Titration of the Acidity of Colored Solutions, by B. G. Hartmann; A Note on the Calculation of the Volume of a Liquid from Weight and Specific Gravity, and The Volatile Reducing Substances in Cider Vinegar, by R. W. Balcom; The Isolation and Identification of Glycerin in

Cider Vinegar, by R. W. Balcom and E. G. Grab; Tartrazin, by Miss A. M. Doyle; C. R. Smith's Method for the Determination of Arsenic, by W. D. Collins; and The Manufacture of Benzaldehyde and Benzoic Acid as a By-Product using Ultraviolet Rays as a Catalyst, by H. D. Gibbs and G. A. Geiger.

Resolutions were adopted on the death during the year of the following members: Prof. Robert James Davidson, of the Virginia Polytechnic Institute; Dr. George Edward Patrick, chief of the Dairy Laboratory of the Bureau of Chemistry; and Thomas Cuthbert Trescot, also of the Bureau of Chemistry.

The following officers were elected for the coming year: J. K. Haywood, Washington, D. C., president; P. F. Trowbridge, Columbia, Mo., vice-president; Carl L. Alsberg, Washington, D. C., secretary and treasurer; and B. B. Ross, Auburn, Ala., and H. C. Lythgoe, Boston, Mass., members of the executive committee. It was decided to hold the next meeting at Washington, D. C., the date to be decided by the executive committee.

Necrology.—Dr. N. H. J. Miller, connected with the Rothamsted Station since 1887, died January 12. His chief work during his long service was the measurement of the amount of combined nitrogen brought down in the rain and the amount of nitric nitrogen washed out from the snow. For over 30 years he had analyzed a sample of every collection of rain from a large rain gauge at the station, obtaining a continuous set of observations of extreme scientific value.

Dr. Miller was also much interested in the literature of agricultural chemistry. For many years he did nearly all the abstracting in chemistry for the British Chemical Society, and in recent years had prepared the society's annual review of progress in that subject.

Marquis de Vogué, president of the Agricultural Society of France, died in November, 1916, at the age of 87 years. Although he was also a diplomatist, a historian, a musician, an architect, and a painter, he was much interested in agricultural chemistry, and installed a laboratory at his chateau at Peseau, where he carried on experiments in the use of fertilizers for potatoes, the use of basic slag, nitrification and the loss of nitrates from lands left uncultivated after harvest, and the effect of the ammoniacal liquor from gas works on the straw of cereals. As president of the society he exerted a considerable influence to improve agricultural conditions in France, especially along economic lines.

Miscellaneous.—Arthur H. Rosenfeld, director of the experiment station at Tucuman, Argentina, since 1914, has resigned and has been succeeded by Dr. W. E. Cross, for several months acting director. Dr. Cross will also continue as head of the department of chemistry, while E. W. Rust has been given charge of the work in entomology. P. V. Janutolo has been appointed assistant in chemistry.

The Cheshire Educational Committee has voted to close the County Council's Agricultural and Horticultural College at Holmes Chapel, England, but a resolution has also been passed asking the Board of Agriculture and Fisheries to take over the institution during the war, with a view to training disabled sailors and soldiers in farm and garden work.

A new feed control station was opened at Wageningen, Holland, November 28, 1916, with Dr. B. R. de Bruyn as director.

THE AGRICULTURAL EXPERIMENT STATIONS OF THE UNITED STATES.

U. S. DEPARTMENT OF AGRICULTURE
STATES RELATIONS SERVICE
A. C. TRUE, DIRECTOR

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EXPERIMENT STATION RECORD

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U. S. DEPARTMENT OF AGRICULTURE.

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BUREAU OF PLANT INDUSTRY—W. A. Taylor, *Chief.*
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THE AGRICULTURAL EXPERIMENT STATIONS.

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Tuskegee Station: *Tuskegee Institute;* G. W. Carver.[1]
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Storrs Station: *Storrs;* }
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State Station: *Baton Rouge;* }
Sugar Station: *Audubon Park, New Orleans;* } W. R. Dodson.[1]
North La. Station: *Calhoun;* }
MAINE—*Orono:* C. D. Woods.[1]
MARYLAND—*College Park:* H. J. Patterson.[1]
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EXPERIMENT STATION RECORD.

VOL. 36. MARCH, 1917. NO. 4.

There are three distinct landmarks in the development of agricultural inquiry in this country. The first was set up when one of the States became sufficiently convinced of the concrete value of agricultural experimentation to the public to establish an experiment station modeled on those of Europe, thus furnishing an example which other States soon began to follow. The second was when the Nation set its seal of approval on these stations, something over twenty years after the first one had been established, and made the system national by providing funds for a station in every State and Territory. The third came nearly twenty years later, in the passage of the Adams Act, which brought with it a new era of intensive searching for fundamental truth.

It is now thirty years since the American system of stations was established under the Hatch Act. It is a little more than ten years since they expanded their operations as a result of the Adams Act. That act passed in the spring of 1906 but had to await an appropriation which came at the very end of the fiscal year—too late for work to be started under it. Hence the year 1907 marked its beginning, and it was not until four years later that the appropriation reached its full amount. For only about half the time since its passage, therefore, has the full appropriation been available.

A decade is a relatively short time in which to measure an influence or a development in science, especially the result of research activity; but the period has brought so many changes and so much progress that it is perhaps worth while to consider these briefly. It has been an era of great activity—one of construction and development, and of large accomplishment. Ideas have been shaped, standards set and accepted, and foundations laid, which have premeated to every State in the Union; and from these have already resulted a new conception of the field and higher function of an experiment station.

From the inception of the experiment stations the question has been working itself out as to what an experiment station is—its peculiar field and function irrespective of special duties assigned to

it under State laws. The American experiment station is a product of American institutions and American ideals. It has no exact counterpart. It has developed as a response to public demands which its own work has in large measure created. Thus, while primarily an agency for acquiring useful and accurate information, the facts it has adduced have led to bestowing upon it police powers for protection of the agricultural industry, and later multiplying its activities in the dissemination of information, conducting propaganda for new branches of the industry or new localities, and in general serving the agricultural interests in a quite broad capacity.

It is interesting to note that the idea of the experiment station as a research institution is almost as old as the American stations. In the first report of the New York State Station, for 1883, Dr. Sturtevant explained that "the object of the station is to discover, verify, and disseminate;" and he showed a very modern view of the scope of each kind of activity. He said: "The leading aim of an experimental station such as ours must be by experimental study of the most careful kind to obtain knowledge of the action of the laws which find application in agriculture, and to devise methods for the application of the knowledge gained, in order that in practical farming waste of means and effort may be diminished and gain may be increased, and thus profits be forwarded."

The reason for agricultural investigation and experiment is that our information may be sound, that reason may prevail, that man may act and conduct his operations rationally. In a large sense it is a study of the relationship of cause and effect. Wherever an effect is observed there has been a cause, and this cause becomes the object of study. If the purpose is to produce a certain effect, knowledge of the phenomena which cause such effects or influence them must be acquired before the effort becomes more than a hit-or-miss process. The scientific method is that which takes account of all the forces acting. To know the law we must understand the law, and this is equally true of a fact or a spray mixture or a method of making cheese.

Science, whether pure or applied, proceeds on the principle that the same causes acting under precisely the same conditions will produce exactly the same effects. In other words, that nature is ordered by law and that there is nothing arbitrary or capricious in its operations. Chance plays no part, and what we observe is a lawful, natural consequence of causes which we may or may not understand. When we do not understand why certain events occur, it means that we do not understand the forces which acted to produce the event. But there is nothing fortuitous or incapable of being understood

through science, either in the elaboration of starch in the growing plant or the benefits from fall plowing.

In the attempt to understand science and its methods much inspiration and help, as well as subject matter, have naturally been borrowed from the older sciences. But the process can not rest there. Agricultural science must itself be productive of scientific results and theories; hence the Adams Act. This Act sprung from a realization that empirical facts and unproved theories were not a safe or sufficient basis for guidance in agricultural teaching, but that a more severe type of inquiry was necessary to develop both the fact and the reason back of it. These and their relationships need to be known before they can be understood and intelligently employed.

The Adams Act was not simply supplementary to the Hatch Act, to enable more of the same kind of work to be done; it was this fact that gave it directing power and has made it so potent in its influence. It was, as its language tried to express, an act to provide for investigation of a high and fundamental order, because progress under the Hatch Act had established the necessity for fundamental study and the activity had gone about as far as it could without additional funds.

The Hatch Act permitted such study and an important amount had been done under it, but it did not limit the activities of the stations to that grade, or so clearly and specifically aim at providing for inquiry which should be original and searching, according to the accepted standards of scientific research. When the Adams Act passed it was characterized as being "the greatest opportunity for continued systematic research along agricultural lines which has ever been presented in any country," and time has borne out this estimate of it. It has given a great impetus to investigation, and it has transformed the American station from being a liberal borrower to being a large and important producer in agricultural science.

The acceptance at the outset of the purpose of the Adams Act as being the promotion of investigation and experiment of research grade and original in character has tended to make the designation "Adams fund project" a sort of hall-mark of quality in experiment station activity. Because the act has consistently represented a high standard, investigators have been ambitious to have projects accepted under it, and have felt a pride in being associated with the Adams fund. In a sense it has made the Adams fund roll regarded as an honor roll.

The necessity of making the investigations thorough and exact in order that they might be dependable and capable of scientific interpretation, has resulted in more care in the matter of methods. At

present there is a far more adequate realization of the limitations of some of the common methods of experimentation than formerly, and recognition that they embody many modifying factors not measured or accounted for. There is a more critical examination of the sources of error, in both observation and interpretation, and a more guarded drawing of broad conclusions.

The standards of the Adams fund studies have affected all forms of station activity. More is expected of experiment station work than formerly—not in quantity but in quality. In the search for new light quantity takes a secondary place. It is the quality, the thoroughness, the reliability of the work that counts. Hasty, unwarranted conclusions have proved expensive in the end, and they have delayed progress by taking men's time to upset them.

These higher standards and expectations have been accompanied by a change in the nature of the problems. The limit of the things which could be found out through accumulated experience or simple experiments and observations has been reached in most lines. These findings have brought the investigator face to face with the more fundamental and intricate questions which require refined and elaborate methods and special research ability for their solution. From this change has followed a far-reaching change in the professional requirements for station work. The qualifications are set higher and made more exacting. It has come to be realized that the measure of efficiency of an experiment station is the sum of the efficiency of its workers.

In 1906, when the Adams Act was passed, the American stations employed 950 persons, of whom 434 did more or less teaching; the majority of those who did no teaching were of the assistant grade or not directly participants in investigation. In 1916 the station forces numbered 1,866, of whim 933 taught to some extent in the colleges, the amount of teaching being very generally reduced. Thus the opportunity for concentrated, continuous effort has increased materially. Furthermore, the investigators have been encouraged to specialize more closely in their studies, at least at any given time. This has become necessary from the nature of the problems, which require more specialized attention.

Other obstacles to research have been reduced or overcome, and the opportunities enlarged. The funds of the stations have increased from a little over two millions when the Adams Act was passed (including the first allotment of it) to considerably over five millions in 1916. Public sentiment for thorough-going investigation has largely developed. The public has come to understand that because a thing or a piece of work is theoretical it is not necessarily unpractical. "Theoretical" and "unpractical" are no longer viewed with suspicion as being synonyms. Some of the most intricate types of in-

vestigation have proved to be highly practical. It is a mark of real progress in public confidence when a station can secure a State appropriation and embark on the most technical studies in the theory of animal nutrition, the relation of ash constituents to nutrition and growth of animals, or the fundamentals of breeding sex-linked characters, with opportunity to pursue its work undisturbed. Indeed, the kind of work which is now in large measure occupying the stations shows how far we have come and the large freedom allowed, provided the ultimate aim is right.

The inspection work has become a much less conspicuous feature of the stations, and has been so organized as to avoid interference with the work of investigation and experiment. Research publications have increased many fold in the last ten years. A considerable number of stations have established research series of bulletins, or otherwise differentiated their technical publications from the regular bulletins intended for the general public. The publication of scientific papers in current journals of this country and Europe has become very common, where formerly it was quite exceptional. The *Journal of Agricultural Research* has been established and furnishes a special medium for station contributions.

Progress is seen also in the organization of station work. It is being developed more largely out of a constructive purpose and in accordance with a definite plan. It is not contingent on something turning up or on what may occur to various members of the staff to undertake. The subject attacked are to considerable extent a part of a general plan for the station, recognizing that it can not cover all questions at any one time, and that a selection must be made based in large measure upon the special requirements in the State. The station is made up of its departments, but it is larger than any single department and in many respects it must act as a unit.

The project system was practically inaugurated with the beginning of activities under the Adams Act. It is an attempt to formulate in an orderly way the purpose and general plan of each separate undertaking. It involves care and thoughtful study in the outlining of new work, in order to take full account of what has been done previously, and to give the work originality and direction. Some time is required in preparation, but this is by no means lost, since it gives force and method to the attack. It is characteristic of all investigation that it is purposeful and is ordered, to the best of ability. The project system guards against aimless, ill-considered, premature undertakings, and it provides a basis, not only for judging of the character of new ventures but of the requirements in carrying them out.

The project system has been extended in large measure to all the activities of the stations, irrespective of the funds from which they are supported. As an administrative measure, it has been found to present many advantages, and where adopted it has met with general satisfaction, as providing a helpful businesslike method of procedure.

Partly as a result of this plan, more systematic effort is now made to secure progress reports of some sort upon the various features of investigation, and to effect the prompt recording and digestion of the data, either for publication or for safe preservation. Report writing is tedious to many workers, especially those who are crowded with work as most station men are, and there is some tendency to allow data to accumulate in a form subject to loss or which would make them difficult for anyone else to work over. There has been considerable waste from this source in the past, and the effort to bring about more systematic procedure is recognized as an important advance.

As to the tangible product of the research conducted under the Adams Act, space will permit reference to only a few features. Where the product is so large it is difficult to make selection, and in any attempt at citing examples there is danger of doing injustice or conferring a wrong impression. For, manifestly, some of the most important pieces of investigation have marked significant steps in the progress toward final conclusions, rather than in themselves having a conspicuous practical end; and many things omitted are quite as important as the few mentioned.

Some of the most significant investigation has been in the field of animal nutrition, of a nature which is to some extent destructive or corrective of former views, but constructive in giving a more accurate insight into the theory of nutrition and the relative value of food constituents. It has been found, contrary to the former belief, that like amounts of food ingredients do not necessarily produce like effects—that there are differences in the constitution of protein from different sources, that not only the kind of protein but the presence of certain amino acids is important, and that apparently other constituents, notably in the fat, have a distinct although not yet fully understood relation to growth.

Similarly, the mineral nutrition of animals is found to be a far more important matter than was formerly suspected; and much light has been thrown on the use made of food by animals at different ages and on different planes of nutrition. The comparative feeding experiment has been largely replaced, except for economic purposes. An Institute of Animal Nutrition has been established in one of the States, and in upwards of a half dozen other States fundamental feeding investigations have been developed on an extensive scale.

The results are to a considerable extent in the theoretical stage as yet, but will ultimately modify in important ways the practical directions for feeding.

The theory of plant and animal breeding will be recognized as another conspicuous feature of the station investigation. In this line knowledge of the theory and practice of plant breeding has been very largely increased by the extensive studies made with various classes of plants and animals, and from different points of view. The investigation has largely changed from the earlier attempts to secure something better, to the search for a more thorough understanding of principles on which the theory and practice may be further perfected and developed. Incidentally many improved strains of plants and animals have been secured, either giving larger production, greater immunity, or otherwise possessing important economic qualities.

The extensive study of inheritance in egg production illustrates a type of work with animals, which has widespread practical value. The experiments in the transmission of characters in mule breeding are unique, and have given an intelligent basis for such operations. In hybridization work with plants a number of hardy plums and other improved fruits have been developed, and valuable qualities of cereals, corn, and cotton have been fixed and perpetuated by line selection. In combating plant diseases the knowledge of breeding has been turned to excellent account, as for example in producing strains of clover immune to anthracnose, cabbage immune to wilt or yellows, and varieties of cereals resistant to diseases.

Many seed-borne diseases have been brought under control by discovery of their weak points. It has been found, for example, that cotton anthracnose can be prevented by delinting the seed with sulphuric acid or treatment with hot water, which destroys the organism, and that bean anthracnose can be prevented in the South by growing the bean crop for seed during the summer, when the fungus can not withstand the hot weather. Studies of the apple rust have shown that it may be controlled by destruction of cedar trees which serve as the alternate host of the fungus, and this finding has resulted in favorable legislation. The extensive studies of the rusts are furnishing a broad basis for economic studies in relation to this class of diseases.

Dairying has to its credit a considerable list of projects which have resulted in important advancements. For example, the studies in cheese ripening and on the rôle of acid in cheese making have led to a new method of cheese manufacturing in which pasteurized milk is employed, using artificial ripeners. This has reduced cheese making more largely to a mechanical process, easily controlled, requiring

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less skilled labor, and yielding a more uniform product. The method avoids the loss in yield and quality due to defective milk, gives a more uniform and sanitary product, and calls for less cold storage in curing.

The determination of the coloring matter in milk might seem at first to have only theoretical interest, but when followed by a similar study of feeds which discloses the relation of certain kinds to light and dark color in milk, cream, and butter, it is seen to have a very practical significance. Similarly, studies of the influence of feed in modifying the chemical and physical properties of butter, while in themselves highly technical, have led to important practical results. To cite an illustration, silage is found to counteract the hardening effect of cottonseed meal upon butter, exercising an opposite effect to cottonseed meal on the fat constants.

Two interesting pieces of work which have a direct application in the feeding of milk to children have dealt with the study of the fat globules and the casein of milk from Holstein and Ayrshire cows as compared with that from Jersey and Guernsey breeds. The size of the fat globules was not found to be a factor. In the case of the first two breeds the casein is more decidedly flocculated, and as it is not so easily curdled in the stomach is apparently more tolerant to infants.

Continued work in dairy bacteriology has served to throw much light on the sources of bacterial contamination of milk and dairy products and to modify some of the earlier precautions prescribed, especially since the cow and the utensils are found to be far more important sources of contamination than the stable and dust.

In horticulture, studies on the factors connected with bud formation are at length yielding light bearing upon the possibilities of control; and other extensive studies in progress have reference to the interrelation of stock and scion, the periodicity of growth in trees, factors which stimulate growth, the specific effects of fertilizers, and hardiness as correlated with structure.

From the long list of successful life history and other studies in economic entomology, the working out of the number of broods of certain insects in different localities, the finding that the woolly aphis of the apple passes part of its life on the elm, producing an affection there, that the sugar-beet plant louse spends some of its life history on the cottonwood tree, the influence of soil moisture and flooding on the control of sugar-beet root louse, may be cited as striking examples of the application of technical studies in suggesting means of control.

The work with fungicides and insecticides, their preparation and use, the manner in which they affect insects, and the conditions under

which they injuriously affect foliage, has been very extensive and has in large measure reduced the practice of spraying to a science. In this connection the working out of the methods of dust spraying and its advantages under certain conditions should be mentioned. After years of unsatisfactory results in the use of gaseous insecticides in mills and grain elevators, striking results have been obtained in ridding these buildings of insect pests by the simple use of heat.

The study on bacillary white diarrhea in poultry and the means by which it spreads, and the finding of a reliable method of diagnosis by which it may be eliminated from breeding flocks, have led to a general campaign against the disease in several States.

The above will be recognized merely as examples in a long list of investigations which have already been productive of important results or are pointing to such conclusions. It is one of the attributes of a scientific discovery that the credit for it usually can not be ascribed entirely to a single person or institution. It develops in part from work which has gone before and has made possible the new or particular application. This is often true of the examples here cited, which recognizes that the stations are not working alone in the great field of agriculutral inquiry.

There are at present nearly five hundred distinct projects being conducted at the stations with the partial or complete support of the Adams fund. This indicates the extent of the enterprise. These projects are in charge of three hundred and eighty leaders and associates. No two projects are alike; each is an individual undertaking. Their diversity shows how far they are removed from any standardizing influence.

Such are some of the developments and evidences of research activity which have come in the past decade. Although this progress can not all be ascribed to the Adams Act, it is due in considerable measure to its direct influence along with the continued experience in investigation. The field has grown to be much larger and the task much deeper than seemed at first. Perhaps one of the greatest truths borne in upon us is the realization that the task is almost endless—that we can never touch bottom in all there is to know about the simplest subjects with which our investigation concerns itself.

Agricultural research has as yet only "stirred a few grains of sand on the shore," but it has made a beginning which seems large in the perspective in which it is viewed and in what it promises. The stations have made some contributions to the theoretical rubbish-heap, which is to their credit, for it proves that originality has been

exercised. And they have made highly important contributions to the knowledge of their day and generation.

In some respects we have learned how not to know, and have set our faces in the right direction—the direction of making our knowledge exact in so far as it goes and as the status of science permits. We have learned not to hesitate to abandon or modify practical and theoretical views on the basis of new light, and so to make our work progressive and constructive by building fact upon fact and sequence upon sequence.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Grain of the tobacco leaf, C. S. RIDGWAY (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 6, pp. 269–288, pls. 3, figs. 2*).—The results of the study reported show that the bodies which cause the grain in cigar tobacco consist of from one to several leaf cells filled with a crystalline substance. These bodies are microscopically visible in ordinary transmitted light, but are more prominent when examined with polarized light. Five forms or types of grain were recognized, but their significance was not investigated. Cryptocrystalline calcium oxalate contained in certain cells in the various tissues of the leaf and single small prismatic crystals scattered evenly throughout the leaf were also identified in the tobacco.

The grain was separated from the leaf by a process of mechanical analysis described in detail. Incidentally in the separation of the grains it was found that, using a sample of 70 gm., 33 per cent of the weight represented midribs, 48 per cent soft tissue, 8 per cent veins (other than the ribs), and 11 per cent the grain. It is noted, however, that these results are only approximate. On analysis the grain bodies were found to have the following percentage composition: Moisture, 8.06; pure ash, 40.26; potassium oxid, 3.42; calcium oxid, 26.34; magnesium oxid, 3.13; oxalic acid, 0.82; citric acid, 22.38; and malic acid, 13.58. Analyses of the leaf web, large vein excluding midrib, and small vein are also submitted. The analytical data indicate that the grain is composed chiefly of calcium with a small amount of magnesium and potassium in combination with citric and malic acids rather than with oxalic acid. Normal calcium malate was identified by petrographic methods.

The grain was found not to be responsible for the marked hygroscopic properties of the tobacco, since the amount of water absorbed by it from a moist atmosphere was less than that absorbed by the other kinds of material. The small veins of the leaf showed the greatest hygroscopicity.

"The grain bodies of tobacco are developed in the course of post-mortem changes which take place during the process of curing and continue during fermentation. A microscopically visible change consists of a more or less complete aggregation of the grain-forming substance of all the cells into certain groups of cells. The factors determining the location of these groups are unknown.

"In the tobacco studied a correlation was found between the grain and burning properties. It is believed that the substances contained in the grain bodies are injurious to the burn, and that the quality of the latter is dependent upon the degree to which the former are aggregated into definite bodies sufficiently separated, one from the other, to permit a considerable fire-carrying zone of cells, emptied of grain material, around each. The influence of the degree of aggregation of the grain substance upon the color, texture, and elasticity of the leaf has not yet been thoroughly investigated."

Tabulated and graphical analytical data relative to the burning quality of the tobacco grown on plats to which various kinds and amounts of fertilizers were applied are submitted.

The chemical composition of lime-sulphur animal dips, R. M. CHAPIN (*U. S. Dept. Agr. Bul. 451 (1916), pp. 16*).—A number of lime-sulphur solutions have been analyzed by the methods previously described by the author (E. S. R.,

35, p. 207) with the view of determining the effect of storage; of lime added after dilution; of varying the lime-sulphur ratio, the period of boiling, and the concentration; the occurrence and relation of calcium sulphite; the ratio of polysulphid to thiosulphate; the lower polysulphids and the effect of an excess of lime; and the higher polysulphids and the effect of oxidation.

The reactions, some of which are reversible, which determine the composition of lime-sulphur solutions are rather numerous. The points of equilibrium vary according as the solution is hot or cold, dilute or concentrated, or exposed to the influence of other varying conditions. "Under such circumstances the only way in which laboratory studies can be of practical value is by so thoroughly establishing the fundamental principles involved and the effect of varying conditions upon the relative importance of such principles as to afford a sound basis for reasoning."

The general reactions between lime and sulphur on boiling with water are indicated as follows:

$$(1)\ 3Ca(OH)_2+12S=2CaS_5+CaS_2O_3+3H_2O$$

$$(2)\ 10CaS_5+3Ca(OH)_2=12CaS_4+CaS_2O_3+3H_2O$$

$$(3)\ CaS_4+S=CaS_5$$

All lime-sulphur solutions are considered to be subject to hydrolytic decomposition according to the following equation, the equilibrium being destroyed by the reaction proceeding to the right with a rise of temperature:

$$(4)\ CaS_x+H_2O\rightleftarrows Ca(OH)_2+H_2S+(x-1)S$$

The products on the right side of the equation further react, giving, in the case of CaS_5,

$$(5)\ CaS_5+3H_2O=CaS_2O_3+3H_2S$$

"A well-boiled solution, not originally made with an excess of lime, can never under any circumstances possess a plus reaction figure—that is, it can not contain calcium hydroxid in excess of monosulphur. If originally made with an excess of lime or if not boiled long enough, excess lime is at first present in solution. But if such a preparation be allowed to stand quietly and cool off in the cooking vat, the indications are that the undissolved lime soon settles down, while the small amount of dissolved lime rapidly reacts with polysulphur according to equation 2, so that in this case, also, unless the cooled solution is again stirred up with the sediment, a plus reaction figure can never be present in the end. But such a solution will naturally contain a notable amount of tetrasulphid."

It is indicated that with an increasing concentration the time of boiling should also be increased. "With increasing concentration the utilization of both lime and sulphur possibly becomes less nearly complete, and also the polysulphids formed possibly contain a somewhat less proportion of pentasulphid. But the apparent effect might have been produced simply by insufficient boiling, and in any event it is of no material significance in comparison with the practical importance of putting out proprietary preparations in highly concentrated form.

"Finished solutions, if stored over sediment which contains free lime, will naturally tend to maintain a plus reaction figure, and will undergo changes attributable to the slow progress of reactions 1 and 2. If decanted from sediment and preserved from access of air, only two slight changes are noticeable; first, the progress of equation 5 until a certain concentration of hydrogen sulphid is reached, when equilibrium is established according to equation 4; second, an apparent slight drop in the thiosulphate figure, for which no explanation is offered, since the phenomenon appeared too quantitatively insignificant to warrant special investigation. Both changes, in fact, are so slight as to be entirely negligible for practical purposes and under ordinary conditions."

The cause of the slight discrepancies between the laboratory experiments and the theoretical results calculated from the equations is discussed. The methods of analysis used are deemed to be adequate in scope and accuracy, and also to be practical. Any loss is considered to arise chiefly during manipulation of the solutions through oxidation, and could be eliminated only by manipulating in an atmosphere of some inert gas.

A formula for preparing an animal dip in which 8 lbs. of quicklime, 18 lbs. of sulphur, and somewhat more than 10 gal. of water are boiled for one hour is submitted.

The arsenates of lead, I, C. C. McDonnell and C. M. Smith (*Jour. Amer. Chem. Soc., 38 (1916), No. 10, pp. 2027–2038*).—Mono-lead arsenate ($PbH_4(AsO_4)_2$) was prepared, and its physical and chemical properties are described. The methods of preparing crystalline di-lead arsenate ($PbHAsO_4$) are reviewed, and its physical and chemical properties fully described. Crystallized tri-lead arsenate, lead metarsenate, and di-lead pyroarsenate were also prepared and their physical and chemical properties noted.

Lead arsenates.—A study of the factors controlling the reactions of lead nitrate and lead acetate with disodium arsenate, G. E. Smith (*Jour. Amer. Chem. Soc., 38 (1916), No. 10, pp. 2014–2027*).—From a study at the Montana Experiment Station of the factors controlling the reactions of lead nitrate and lead acetate with disodium arsenate, the author concludes that "the lead arsenates produced are mixtures of diplumbic arsenate ($PbHAsO_4$) and lead hydroxyarsenate ($Pb_5OH(AsO_4)_3$). The products of the reactions at low temperatures, when the reactions have come to an equilibrium, whether lead acetate or lead nitrate is used consist principally of diplumbic arsenate. The products of the reactions at infinite dilutions (less than 1/1,000-molar), whether lead acetate or lead nitrate is used, consist principally of lead hydroxyarsenate if the precipitates are filtered immediately after the precipitation. The precipitate that is first formed is lead hydroxyarsenate; diplumbic arsenate is produced by a secondary reaction."

With an increase of alkaline disodium arsenate greater amounts of lead hydroxyarsenate are produced. As the concentration increases the relative amount of diplumbic arsenate increases. With an increase in temperature more of the hydroxyarsenate is formed.

The procedures used for the preparation of the pure reagents and the materials studied are described in detail.

Researches on organic periodids.—II, Periodids of antipyrin, iodoantipyrin, and pyramidone, W. O. Emery and S. Palkin (*Jour. Amer. Chem. Soc., 38 (1916), No. 10, pp. 2166–2181*).—A continuation of previous work (E. S. R., 34, p. 502).

Preparation of bromoacetylglucose and certain other bromoacetyl sugars, J. K. Dale (*Jour. Amer. Chem. Soc., 38 (1916), No. 10, pp. 2187, 2188*).

Condensation of thiobarbituric acid with aromatic aldehydes, A. W. Dox and G. P. Plaisance (*Jour. Amer. Chem. Soc., 38 (1916), No. 10, pp. 2164–2166*).—In the course of a study at the Iowa Experiment Station on the reaction between aromatic aldehydes and the methylene group of the ureids of malonic acid, a number of condensation products were prepared and are described.

Concerning certain aromatic constituents of urine, R. J. Anderson (*New York State Sta. Tech. Bul. 55 (1916), pp. 3–25; Jour. Biol. Chem., 26 (1916), No. 2, pp. 387–415*).—This bulletin reports the following studies:

I. *The nonphenolic volatile oils of cow urine.*—The author has shown that the so-called neutral oil obtained from cow urine consists for the greater part

of para-cresol. A very small percentage of an aromatic and nonphenolic oil of agreeable odor, having the composition $C_{10}H_{16}O$, was also present with the oil. This substance was found to be present in larger amounts during the summer months than during the winter, and the oils eliminated at the two seasons not to be chemically identical. It is indicated that the nature of these substances apparently depends upon the nature of the terpene-like bodies contained in the feed which the animals obtain.

The terms "urogon" and "urogol," used by Mooser,[1] have been shown to be identical with the mixture of para-cresol and the nonphenolic oil described.

II. *The nonphenolic volatile oils of goat urine.*—Experimental data presented show that the neutral oil obtained from goat urine which has been previously described[2] under the name of "urogon" is not a chemical entity but a mixture. The substances isolated are identical with the oils isolated from cow urine.

III. *The nonphenolic volatile oils of horse and human urine.*—A neutral alkali-insoluble oil which had the composition corresponding to the formula $C_7H_{12}O$ was isolated from horse urine. An oil of similar composition and properties was found in human urine. On account of the very small yield obtained the oils could not be identified. It is deemed probable that "the kind of neutral alkali-insoluble oils excreted in the urine of different animals will be found to depend to a large extent upon the nature of the terpene-like bodies contained in the food, and for this reason the nature of the oil will vary in accordance with season and the available food supply."

The chemistry of the vitamins, R. R. Williams (*Philippine Jour. Sci., Sect. A, 11 (1916), No. 2, pp. 49–57*).—The author describes a method for separating the vitamin of rice polishings and reports the preparation of several derivatives of nicotinic acid, the curative property of these derivatives being tested by feeding per os to neuritic fowls.

The chemical nature of the "vitamins".—II, Isomerism in natural antineuritic substances, R. R. Williams and A. Seidell (*Jour. Biol. Chem., 26 (1916), No. 2, pp. 431–456, pl. 1, figs. 5*).—Continuing the work previously noted (E. S. R., 35, p. 711), the authors have found that the physiological properties of autolyzed yeast are not appreciably altered by treatment with relatively concentrated caustic alkali. Aqueous alkali in contact with fullers' earth "activated" by contact with autolyzed yeast filtrate modified the physiological action of the yeast filtrate in respect to its power to maintain the weight of pigeons on a deficient diet, but did not sensibly affect its antineuritic function.

A crystalline antineuritic substance was obtained by alkaline extraction of "activated" fullers' earth, the physiological action of which was apparently not due to adhering mother liquor. Attempts to purify this substance by recrystallization resulted in a loss of its antineuritic properties. The resulting product was found to be identical with adenin, and by suitable treatment again acquired antineuritic properties. From the results thus obtained it is deemed probable that an isomer of adenin is the chemical entity responsible for the characteristic physiological properties of the vitamin investigated.

The experimental data are described in detail and the chemical nature of the vitamins discussed. In connection with the latter it is suggested that "the vitamins contain one or more groups of atoms constituting nuclei in which the physiological properties are resident. In a free state these nuclei possess the vitamin activity, but under ordinary conditions are spontaneously transformed into isomers which do not possess antineuritic power. The complementary substances or substituent groups with which these nuclei are more or less firmly

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[1] Hoppe-Seyler's Ztschr. Physiol. Chem., 63 (1909), No. 2–3, pp. 155–200.

[2] Pflüger's Arch. Physiol., 156 (1914), pp. 225–252.

combined in nature exert a stabilizing and perhaps otherwise favorable influence on the curative nucleus, but do not in themselves possess the vitamin type of physiological potency. Accordingly it is believed that while partial cleavage of vitamins may result only in a modification of their physiological properties, by certain means disruption may go so far as to effect a complete separation of 'nucleus' and 'stabilizer,' and if it does so will be followed by loss of curative power due to isomerization."

The terminology introduced by McCollum and Kennedy (E. S. R., 35, p. 166), based on the solubility of the substances isolated, is considered by the authors to be an unfortunate choice because of the influence of various other substances on solubility, and in their discussion they retain the word vitamin, as employed by Funk.

On the products of the action of certain amylases upon soluble starch, with special reference to the formation of glucose, H. C. SHERMAN and P. W. PUNNETT (*Jour. Amer. Chem. Soc., 38 (1916), No. 9, pp. 1877–1885*).—Experiments are described from which it is concluded that any of the amylases tested (pancreatic, malt, and taka-diastase) may form some glucose. Under the conditions which prevail in the usual determinations of diastatic power, however, the yield of maltose so far predominates as to justify the custom of calculating the reducing powers of the digestion products as due to maltose alone.

Experiments upon starch as substrate for enzym action, H. C. SHERMAN and J. C. BAKER (*Jour. Amer. Chem. Soc., 38 (1916), No. 9, pp. 1885–1904*).—"Dispersions of commercial potato starch in water or of purified potato starch in water containing a small amount of electrolyte (sodium chlorid) have been separated by centrifugal force into a heavier, very viscous, opalescent layer containing the more abundant, less soluble component of the starch (Meyer's α-amylose, Maquenne's amylopectin), and a lighter, limpid solution containing the less abundant, more soluble component (Meyer's β-amylose, Maquenne's amylose)."

It is indicated that the centrifugal method described for the separation of the starch components does not completely separate either component from the other, but affords a means of approximate separation in which the danger of contamination, denaturization, or retrogradation is minimized. The method is well adapted to the study of the effects of the different amylases.

"Pancreatic amylase both in commercial and in highly purified form produced reducing sugar more rapidly from β-amylose than from α-amylose, autoclaved starch, or Lintner soluble starch, the last three giving very similar results when used as substrate for this enzym. Not only does the β-amylose substrate show a larger yield of maltose at each of the various time intervals tested, but the initial speed of hydrolysis is better maintained with this substrate than with either of the others.

"Purified malt amylase shows in the earlier stages of its action a somewhat greater yield of maltose from α- than from β-amylose. As the digestion proceeds the saccharogenic action of this enzym upon α-amylose becomes slower, while its action upon β-amylose is well sustained, so that in cases in which the hydrolysis proceeds to the production of more than half the theoretical yield of maltose the final result shows a greater saccharogenic action upon β- than upon α-amylose. The results obtained upon autoclaved starch and Lintner soluble starch are very similar to those found with α-amylose."

Taka-diastase was found to digest Lintner soluble starch, autoclaved whole starch, and α-amylose at about equal rates, and β-amylose at a somewhat higher rate. The action of pancreatic or malt amylase is better sustained than that of taka-diastase upon the β-amylose substrate. "This relatively early falling off

in the speed of sugar formation, together with the high ratio of amyloclastic to saccharogenic power, indicate that this amylase is a more active catalyst of the earlier than of the later stages of the hydrolysis."

The data submitted indicate that "Lintner soluble starch is well adapted to its purpose as substrate for testing the activities of the different amylases, and that its use leads to conservative estimates of the diastatic powers of purified preparations."

An examination of certain methods for the study of proteolytic action, H. C. SHERMAN and DORA E. NEUN (*Jour. Amer. Chem. Soc., 38 (1916), No. 10, pp. 2199–2216, figs. 4*).—The Mett method for determination of total nitrogen of digestion products, the measurement of the increase of amino nitrogen by the Van Slyke method, the titration of the acidity of digestion products, the increase of electrical conductivity, the polariscopic method, and the biuret and ninhydrin reactions for determining the proteolytic activity were studied in detail. The experimental results are submitted in tabular form.

It is indicated that in general the quantitative determination of the total nitrogen or the amino nitrogen of the digestion products appears to be more delicate as a means of detecting proteolysis than either the biuret or the ninhydrin reaction, and more delicate, accurate, and generally applicable than any of the other quantitative methods studied. "The results emphasize the importance, in quantitative comparisons, of so limiting the amount of enzym preparation and the time of its action as to keep within the region in which the velocity of hydrolysis is directly proportional to the enzym concentration."

Nitrogen determinations by direct nesslerization, O. FOLIN and W. DENIS (*Jour. Biol. Chem., 26 (1916), No. 2, pp. 473–506*).—Five papers are presented.

I. *Total nitrogen in urine* (pp. 473–489).—A colorimetric procedure is described in detail. For the digestion of the sample a mixture of phosphoric and sulphuric acids (3:1) is recommended on account of its markedly reducing the amount of sulphate in the digested material and thus obviating the possible precipitation of the colored mercury ammonium compound in the color comparison.

Comparative analytical data with the standard Kjeldahl method indicate the accuracy of the micro-procedure.

Notes on the destructive digestion of urine, Nessler's reagent, the neutralization and dilution of the digestion mixture, standard ammonium sulphate solutions, the use of Ostwald pipettes, and the use of the colorimeter are included.

II. *Nonprotein ntirogen in blood* (pp. 491–496).—Metaphosphoric acid (so-called "glacial" phosphoric acid) has been found to be an excellent protein precipitant. It is indicated as being better than colloidal iron and fully as good as trichloroacetic acid.

The determination of nonprotein nitrogen is described as follows: To 20 cc. of water in a 50-cc. volumetric flask 5 cc. of blood is added, and then 3 cc. of a 25 per cent metaphosphoric acid. The liquid is thoroughly mixed and allowed to stand for from 1 to 24 hours, after which the flask is filled to the mark, thoroughly agitated, and the contents filtered through a dry filter. It is important that the mixture be allowed to stand for a sufficient time before filtration. An aliquot, corresponding to 1 cc. of blood, of the perfectly clear and colorless filtrate is used for determining the nitrogen, the procedure being essentially the same as that used in urine samples.

III. *Ammonia in urine* (pp. 497–499).—A procedure in which blood charcoal (ammonia-free) is used to remove the creatinin and other reducing substances found in urine, so that the nesslerized filtrates remain clear for several hours, is described. A small amount of metaphosphoric acid is added to insure the

presence of all the ammonia as salts, since the free ammonia is absorbed by charcoal. Analytical data submitted indicate that the new procedure is absolutely reliable.

IV. *Urea in urine* (501–503).—In the procedure described the urea is decomposed in the usual manner by urease, and after removal of the urease materials with metaphosphoric acid and treatment with blood charcoal the filtrate is nesslerized and the ammonia determined as usual. Comparative analytical data submitted indicate the accuracy of the procedure.

V. *Urea in blood* (pp. 505, 506).—The method described is essentially the same as that used in the determination of urea in urine.

Estimation of calcium in ash of forage plants and animal carcasses, S. B. KUZIRIAN (*Jour. Amer. Chem. Soc., 38 (1916), No. 10, pp. 1996–2000*).—A rapid and accurate modified procedure is described by the author, at the Iowa Experiment Station, which consists essentially in removing the phosphorus as phosphomolybdate from an acid solution of the ash and precipitation of the calcium from the filtrate as calcium oxalate, either directly or after the removal of the excess of molybdenum as sulphid. No advantage was found, however, in the latter process.

Advantages claimed for the procedure as compared to the official basic acetate method (E. S. R., 20, p. 512) are that it yields more accurate and concordant results; no attention need be given to the maintenance of exact neutrality of the solution; the volume of the filtrate resulting from the precipitation of phosphorus can be kept reasonably small, so that no evaporation is necessary; the time required for the determination is greatly shortened; and phosphorus and calcium may be determined in the same aliquot.

The method outlined by Shedd (E. S. R., 27, p. 616) has been found to yield excellent results with slight modifications, which consist essentially in boiling the calcium oxalate precipitate for 30 minutes on a hot plate, filtering through a Gooch crucible, and igniting to convert the oxalates into oxids instead of dissolving the precipitate with hydrochloric acid and reprecipitating with dilute ammonia, which operation seems to be insufficient to remove completely adhering traces of molybdenum. The ignited residue is then dissolved in dilute hydrochloric acid, filtered, ammonium chlorid and ammonia added, and the liquid boiled until the odor of ammonia is faint. The precipitated iron and aluminum are removed and the calcium precipitated as oxalate.

Modification of the Pratt method for the determination of citric acid, J. J. WILLAMAN (*Jour. Amer. Chem. Soc., 38 (1916), No. 10, pp. 2193–2199*).—After a thorough study of the various steps in the method described by Pratt (E. S. R., 26, p. 509) the following modified method is outlined:

The pectins in the fruit juice or other plant material are precipitated by two volumes of 50 per cent alcohol, and the precipitate, after settling, filtered through filter paper on a Büchner funnel and washed twice with 65 per cent alcohol. The filtrate is diluted with water to give approximately a 30 per cent alcohol content by volume, and 5 cc. of barium acetate solution then added. The barium citrate is filtered through asbestos in a Gooch crucible, washed with 30 per cent alcohol, and dried in a water oven. The precipitate is dissolved in hot 6 per cent phosphoric acid solution, using three portions of 20 cc. each and followed by hot water. The filtrate and washings (which should be about 100 cc. in volume) are transferred to the oxidation flask, a piece of glass tubing or glass beads added, if necessary, to prevent bumping, and the solution oxidized with potassium permanganate as described in the original method. The adapter of the condenser dips into 40 cc. of Denigés' solution contained in a 500 cc. Erlenmeyer flask. After the oxidation is com-

plete the distillate is made up to about 300 cc. volume, put under a reflux condenser, and boiled gently for 45 minutes. The precipitate is then filtered hot through paper, washed by decantation twice with hot water, and dissolved in two or three small portions of 5 per cent hydrochloric acid by heating. The acid solution is, after cooling, neutralized with 10 per cent sodium hydroxid, and made up to 100 cc. volume.

The whole or an aliquot of the mercury solution can be titrated against standard potassium iodid solution, or the mercuric chlorid solution can be used in a burette and titrated against standard potassium iodid. A determination factor giving the citric acid equivalent of cubic centimeters of potassium iodid is included. Malic, tartaric (except quantities of 5 gm. or over), oxalic, and aconitic acids do not interfere with the determination. The presence of large amounts of sugar or other substances capable of reducing permanganate tends to yield slightly high results, but the difference is inconsiderable.

Analytical data are submitted which indicate that the modified method, if followed rigidly, will give much more satisfactory results than the original procedure.

A comparison of barbituric acid, thiobarbituric acid, and malonylguanidin as quantitative precipitants for furfural, A. W. DOX and G. P. PLAISANCE (*Jour. Amer. Chem. Soc., 38 (1916), No. 10, pp. 2156–2164*).—Experimental data submitted by the authors from the Iowa Experiment Station demonstrate that thiobarbituric acid condenses readily with furfural in 12 per cent hydrochloric acid solution, and forms, by the elimination of one molecule of water, a definite compound to which a definite chemical formula can be ascribed. The reaction is quantitative, yielding a voluminous precipitate which can be filtered, dried, and weighed. Thiobarbituric acid is indicated as being superior to phloroglucinol as a precipitant for furfural, and no correction for solubility of the product is necessary. It is also preferable to barbituric acid, for the reason that the reaction is quantitative with as small amounts of furfural as 12 mg., and a large excess of percipitant is unnecessary, thus avoiding possible errors due to inclusion. The precipitant has a further advantage in that the percentages of nitrogen and sulphur can be easily determined in cases where doubt might exist as to the purity of the product in case homologues of furfural were present.

It is suggested that thiobarbituric acid, which can be prepared in a pure state with little difficulty, may be found useful in the analysis of agricultural products, in place of phloroglucinol or barbituric acid, for the determination of pentoses and pentosans.

Methods in soil analysis, F. E. BEAR and R. M. SALTER (*West Virginia Sta. Bul. 159 (1916), pp. 3–24, figs. 2*).—This bulletin outlines in detail methods for complete soil analysis which have been found reliable by their successful use in several hundred analyses of various types of West Virginia soils.

The estimation of thiosulphate sulphur in lime-sulphur solutions by iodin titration, P. L. BLUMENTHAL and S. D. AVERITT (*Jour. Amer. Chem. Soc., 38 (1916), No. 9, pp. 1701–1704*).—From a study carried on at the Kentucky Experiment Station, the authors conclude that "an excess of iodin does react with tetrathionate in neutral or faintly acid solutions upon standing. In every iodin titration on a lime-sulphur solution a small quantity of sulphate is formed; in some lime-sulphur solutions this is the only sulphate found.

"The quantity of iodin used to form sulphate in an ordinary titration does not cause an appreciable error in the determination of thiosulphate. The iodin value obtained after decomposing polysulphids by HCl titration actually represents thiosulphate, since the barium sulphate obtained from such solutions

after oxidation agrees very closely with the titration values. The presence of sulphites, which would also be titrated at this point, would tend to cause high results for thiosulphate as calculated from the iodin value. If anything, the gravimetric results for thiosulphate are a trifle higher than the titration values, which point to an absence of sulphites, although this in itself is not absolute proof of the fact."

See also a previous note by Averitt (E. S. R., 36, p. 16).

[Report of the chemical division], C. H. WRIGHT (*Fiji Dept. Agr. Ann. Rpt. 1915, pp. 22–26*).—These pages report brief notes on soil analysis, physical and chemical constants of lemon grass oil distilled under varying conditions, and the examination of bat guanos, limes and coral sand, mustard oil, coconut products, lemons, and miscellaneous materials.

Experiments on the conservation of fruits and vegetables by desiccation, V. VALVASSORI (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 13 (1916), No. 2, pp. 56–64, fig. 1*).—This article briefly describes some experiments obtained in a study of fruit and vegetable conservation by desiccation with heat, and indicates the great economic importance of the industry. A table giving the time necessary for sterilization, optimum temperatures and time necessary for desiccation, and yield of finished product from 100 kg. of fresh material of a number of vegetables is included.

Instructions for processing fruits and vegetables for exhibition only, J. H. PAGE (*Bur. Mines, Manfrs. and Agr. [Ark.], Bul. 4 (1916), pp. 15*).—This bulletin briefly describes procedures and gives formulas for preserving fruits and vegetables for exhibition purposes.

Report on vegetable dyestuffs, F. MARSDEN (*Mysore Econ. Conf. [India], Indus. and Com. Committee Bul. 31 (1916), pp. VII+15*).—This is the report of the work carried out by the dyeing expert to the Government of Madras in connection with the utilization of indigenous or other materials in the dyeing industry. An introduction by A. Chatterton, director of industries and commerce in Mysore, is included.

From the results of the investigation it is concluded that the indigenous materials are incapable of meeting the demands which have been created by the development of the manufacture of synthetic colors.

SOILS—FERTILIZERS.

Measurement of the surface forces in soils, C. A. SHULL (*Bot. Gaz., 62 (1916), No. 1, pp. 1–31, figs. 5*).—Experiments conducted at the universities of Kansas and Chicago on the force with which particles of soils of varying fineness retain moisture at different degrees of dryness and to devise a method for measuring this force are reported. The soils used were heavy silt clay, fine quartz sand, loam, very fine sandy loam, sand, and fine sand.

The seeds of *Xanthium pennsylvanicum* were used to measure the moisture-holding powers of the soils by firmly packing dry seeds of known weight in a soil of known moisture content and allowing the forces tending to move the moisture to reach equilibrium. The force with which these seeds absorb water was first determined by the use of osmotic solutions and by the vapor pressure equilibrium method, the former being found the more reliable. The air-dried seeds showed an initial attraction for water of nearly 1,000 atmospheres, and it was found that the attraction which exists at any moisture content between saturation and air dryness can be approximated.

In the experiments with soils it was found that the air-dry subsoil of the silt loam held its hygroscopic moisture with about the same force as an air-dry

seed; that is, about 1,000 atmospheres. As the moisture content of the soil increased the surface force decreased rapidly. When about 3.5 per cent of water was added to the air-dry soil, the force remaining was about 375 atmospheres. When the moisture content reached 6 per cent above air-dry in this soil it was held with a force of 130 or more atmospheres. At 11 per cent above air-dry the holding power fell to 22.4 atmospheres. At the wilting coefficient of the soil (13.3 per cent above air-dry in the silt loam subsoil) the "back pull" of the soil particles amounted to not more than that of a 0.1 molecular volume sodium chlorid solution; that is, not more than about 4 atmospheres. This was shown to hold true for a number of types of soil with widely varying wilting coefficients.

"The wilting of plants at the wilting coefficient of the soil can not be due to lack of moisture in the soil, nor to lack of a gradient of forces tending to move water toward the plant. The view is held, therefore, that the wilting at this critical soil moisture content must be due to the increasing slowness of water movement from soil particle to soil particle, and from these to the root hairs, the rate of movement falling below that necessary to maintain turgidity of the cells of the aerial parts even under conditions of low transpiration."

Thirty-six references to literature bearing on the subject are also cited.

Use of two indirect methods for the determination of the hygroscopic coefficients of soils, F. J. Alway and V. L. Clark (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 8, pp. 345–359, fig. 1*).—Experiments conducted at the Nebraska Experiment Station on the determination of the hygroscopic coefficients of a number of Nebraska soils from their maximum water capacities and their contents of hygroscopic moisture are reported.

It was found that while the Briggs-Shantz formula, hygroscopic coefficient= (maximum water capacity −21)×0.234 (E. S. R., 26, p. 628), "with many soils gives values fully in accord with those directly determined, with many others it gives results so widely divergent that it can not be regarded as sufficiently reliable for studies of available soil moisture, or even for soil-survey purposes."

The studies of the relation between hygroscopic coefficient and hygroscopic moisture showed "that the hygroscopic coefficient may be calculated from the hygroscopic moisture found in a soil which has been allowed to come into equilibrium with an only partially saturated atmosphere, and that this method will require only simple equipment, a minimum of skill on the part of the operator, and be so economical of time as to recommend it wherever a very large number of samples have to be dealt with."

Note on soil denudation by rainfall and drainage: Conservation of soil moisture, G. D. Hope (*Agr. Jour. India, 11 (1916), No. 2, pp. 134–141, pls. 4*).—Suggestions for the prevention of erosion of northeast Indian tea soils are given, special reference being made to terracing and drainage as practiced on Java tea soils.

Soil aeration in agriculture, A. Howard (*Agr. Research Inst. Pusa Bul. 61 (1916), pp. 22, pls. 2, figs. 3*).—This is a lecture delivered at the meeting of the Board of Agriculture at Pusa, India, on soil ventilation in its physiological relation to crop production, including some practical applications of soil aeration by means of drainage, irrigation, and manuring.

The toxicity of bog water, G. B. Rigg (*Amer. Jour. Bot., 3 (1916), No. 8, pp. 436, 437*).—Experiments made at the University of Washington with waters drawn from sphagnum bogs of the Puget Sound region and Alaska are reported.

It is reported that "(1) when they were filtered through filter paper, then saturated with NaCl, $MgSO_4$, Na_2HPO_4, or $(NH_4)_2SO_4$, and allowed to stand

over night, the samples tested have all shown a precipitate. (2) When this precipitate was filtered off and the filtrate dialyzed in a dialyzing tube in running water until it no longer showed a precipitate with $BaCl_2$, the filtrate did not prove toxic to root hairs on Tradescantia cuttings placed in it, while controls in bog water allowed only a very poor development of root hairs on cuttings of this species. (3) When 500 cc. of filtered bog water was distilled until the residue was only 80 cc., the distillate was colorless and was not toxic to root hairs on Tradescantia cuttings while the residue was much darker in color than bog water and almost entirely inhibited the formation of root hairs on these cuttings. (4) When saturated with $(NH_4)_2SO_4$ and allowed to stand over night, the above distillate gave no precipitate, while the residue gave a much heavier precipitate than untreated bog water did. (5) All samples of bog water tested were acid to litmus and to phenolphthalein. (6) The acidity of the residue mentioned in (3) was greater than that of the untreated bog water, while the acidity of the distillate was less than that of the untreated bog water. The acidity was determined by neutralization with N/20 NaOH, using phenolphthalein as an indicator. . . . The fact that the osmotic pressure of bog water is very low suggests that the material in solution in it is probably in a colloidal state. The data here given seem to confirm this view and to warrant the suggestion that this colloidal matter is a large factor in the toxicity of the water."

A list of ten references to literature bearing on the subject is appended.

Some factors influencing nitrogen fixation and nitrification, B. WILLIAMS (*Bot. Gaz., 62* (*1916*), *No. 4, pp. 311–317*).—In continuation of work previously reported (E. S. R., 33, p. 620), experiments conducted at the Virginia Experiment Station on nitrogen fixation in garden soil and in various other soils stored in the laboratory for periods of different lengths showed that the nitrogen-fixing flora significantly decreased in its activity under the influence of drying. This deterioration was manifested as early as two weeks after removing the soil from the field and exposing it to the ordinary laboratory conditions of drying. After 15 months, however, a number of soils retained an ability to fix nitrogen, which is taken to indicate that some species at least have considerable resistance to drying. A number of qualitative tests for Azotobacter in soils kept in storage for 15 months indicated that this organism is more easily attenuated than some other species. Further tests with three soils with low powers of fixation showed that the soil extract itself "probably does not carry substances which would retard fixation."

A continuation of studies on nitrification in soils of poor nitrifying power to which sugar and lime were added showed that without the use of lime a number of soils completely failed to nitrify ammonium sulphate, and few exhibited what might be termed an average nitrifying power. Under the influence of lime there was an increase of nitrifying power in the majority of the soils, although the stimulation was not especially noteworthy. "It appears that where there is some development of the nitrifying flora in the soil originally the effects of lime are decidedly more evident than in those soils apparently devoid of nitrifying power."

There was no formation of nitrates whatever under the influence of 2 per cent of mannite. It not only failed to afford a source of energy for the nitrifying ferments, but exerted a depressing effect on the activities of such as were present.

Production of alkali in soils by denitrification, R. ALADJEM (*Cairo Sci. Jour., 8* (*1914*), *No. 99, pp. 274–278*).—Studies on the processes of nitrification and denitrification in sandy loam soil and the conditions governing them are reported.

It was found that when nitrification takes place in soil which contains even traces of sodium, potassium, and calcium, the corresponding nitrates are formed which—when conditions favorable to denitrification, such as water-logging, are produced—are decomposed, giving rise to alkaline bicarbonates. It was found that such denitrification takes place only when the soil is so saturated with water as to be completely deprived of air. The alkaline bicarbonates formed are capable under certain conditions of being transformed into carbonates.

Further observations on protozoa in relation to soil bacteria, T. GOODEY (*Proc. Roy. Soc. [London], Ser. B, 89 (1916), No. B 616, pp. 297–314, figs. 5; abs. in Jour. Soc. Chem. Indus., 35 (1916), No. 17, p. 936*).—In continuation and extension of work previously reported (E. S. R., 33, p. 515) on the inoculation of protozoa into soil, experiments are reported with a fibrous loam soil representing an attempt to eliminate the source of error of the previous experiments occasioned by introducing large numbers of bacteria into the soil along with the added protozoa. The aim was to inoculate a partially sterilized soil with protozoa freed from bacteria. A method is described whereby protozoa were successfully separated from large numbers of bacteria and used for mass inoculation of a treated soil.

It was concluded from the results obtained that "protozoa, especially amœba of the *limax* group and other larger forms, can lead an active existence and multiply in soil and exert a depressing effect on bacterial numbers." It is considered probable that for a given soil a certain point must be reached in protozoal numbers before the depression in bacterial numbers is caused. In the soil under investigation this number appeared to be approximately 30,000 *Amœba limax* per gram. It appeared to be necessary to add the protozoa to a treated soil in a small quantity of untreated soil to insure their having a suitable medium in which to grow and multiply. It did not appear possible to carry out mass inoculations of protozoa into treated soil in such a way that they come into action and limit bacterial activity, and the explanation advanced to account for this failure is that the treated soil alone affords an unsuitable medium for the active trophic existence of protozoa.

Soils of the Sabak district on the Bernam River, J. GRANTHAM (*Agr. Bul. Fed. Malay States, 4 (1916), No. 9, pp. 298–300*).—Mechanical and chemical analyses of 13 samples of coconut and jungle soils are reported and discussed. The soils of the district are all of the heavy clay type of medium acidity and of alluvial origin, with the clay portion varying from about 20 to over 40 per cent, the higher percentage preponderating. They contain a fair percentage of organic matter and are characterized by being unusually rich in potash and nitrogen. The phosphate content, while rather low, is said to be above the average for the country.

Investigation of the peat bogs and peat industry of Canada, 1913–14, A. ANREP (*Canada Dept. Mines, Mines Branch Bul. 11 (1915), pp. XII+185, pls. 122, figs. 66*).—Particulars are given of the detailed examination of peat bogs in the Provinces of Ontario, Quebec, Prince Edward Island, and Nova Scotia. In addition are included over 60 photographic illustrations of plants found in and composing the bogs investigated, and a number of translations of official documents on the utilization of peat, dealing with recent developments in European practice.

The analysis of soils, L. J. WILD (*Jour. Canterbury Agr. and Past. Assoc., 3. ser., 4 (1916), pp. 35–41*).—A brief discussion of the numerous factors upon which the fertility and productiveness of a given soil depends is given in order to show the impracticability of attempting to judge a soil on the basis of analytical data only.

Bureau of Soils, U. S. Department of Agriculture, M. WHITNEY (*Cornell Countryman, 14 (1916), No. 1, pp. 18–22, figs. 2*).—This is a brief outline of the chief activities of the Bureau of Soils.

Artificial manures, 1916 (*Glamorgan County Council, Agr. Committee [Pamphlet], 1916, pp. 4*).—Brief suggestions on manures and manuring to meet wartime conditions in England are given.

Soil fertility considerations in the feeding of hogs and milch cows, E. B. FORBES (*Mo. Bul. Ohio Sta., 1 (1916), No. 11, pp. 351, 352*).—In a series of income and outgo experiments with five growing hogs, it was found that on the average the excreta contained 74, 87, and 86 per cent of the nitrogen, phosphorus, and potassium of the rations fed. In two series of experiments with six cows in each, it was found that the excreta contained 67.45, 74.4, and 71.6 per cent of the nitrogen, potassium, and phosphorus, respectively, of the rations fed, being in all cases appreciably less than the percentages found in the excreta of the growing hogs.

Plant food deficiencies of Coastal Plain and Piedmont soils, C. B. WILLIAMS (*Jour. Indus. and Engin. Chem., 8 (1916), No. 9, pp. 823, 824; Proc. Soc. Prom. Agr. Sci., 36 (1915), pp. 67–75*).—Data showing the average amounts of nitrogen, phosphoric acid, and potash in the leading soil types of the Coastal Plain and Piedmont regions in which field work has been conducted by the North Carolina Experiment Station are reported, which indicate that "potentially most of the soils are fairly well supplied with potash, but that the amounts of phosphoric acid and nitrogen, one or the other, or both, are at present or soon will be limiting factors in the production of large crops." Data obtained in field fertilizer experiments by the station are taken to indicate that the "chief needs for plant growth in the Coastal Plain region are generally first for nitrogen, and second for potash and lime. Those soils of chief importance and extent in the Piedmont region show a lack first for phosphoric acid, and second for nitrogen. Without the addition of these deficient plant food constituents, it will be impossible to grow large crops for any great length of time."

Note on the soil of the experimental farms [in Burma], F. J. WARTH (*Dept. Agr. Burma Bul. 13 (1913), pp. 9*).—Pot culture experiments on alkaline heavy clay and clay, neutral clay loam, sand and sandy loam, slightly acid sand and sandy loam, and strongly acid clay paddy soils are reported, together with chemical analyses of the different soils, the purpose being to throw light on the problem of availability of phosphoric acid in paddy soils.

It was found that with the soils used citric acid extraction forms no criterion for the amount of phosphoric acid available for a paddy crop. Pot cultures showed that a shortage of phosphoric acid was felt at a very early stage. This shortage in the case of a long-lived variety grown under favorable conditions is in time more or less made up as the plant develops. The normal yields of paddy from the four heavy soils were least, and these soils also were deficient in phosphoric acid. "The figures for total and available phosphoric acid given in the soil analysis . . . are undoubtedly an index of the total supply of this substance and its state of occurrence."

Fertilizer experiments with sugar cane on the red clay soil, P. L. GILE and J. O. CARRERO (*Porto Rico Sta. Rpt. 1915, pp. 16–24*).—In continuation of investigations previously noted (E. S. R., 30, p. 818) experiments to determine the fertilizer requirements of areas found to respond to fertilizers in the previous work are reported.

The results of four experiments on the effect of fertilizers on sugar cane on the lowland red clay soil, involving 290 plats and 58 acres of land, showed that one field failed to respond to 3,500 lbs. of quicklime per acre with and without

various commercial fertilizers. On another field all combinations of nitrogen, phosphoric acid, and potash applied at the rate of 50 lbs. of each element per acre were ineffective. On two other fields fertilizers measurably increased the yield. Where the land responded to fertilizers nitrogen was the only essential element. A single test with plant cane showed that, calling the effectiveness of ammonium sulphate 100, that of sodium nitrate was 100, that of tankage 111, and that of cyanamid 134.

The residual effects of fertilizers, F. E. Bear, R. M. Salter et al. (*West Virginia Sta. Bul. 160 (1916), pp. 3–26, figs. 2*).—Analyses of samples of the soil of fertilizer plats which have been under experiment for 15 years at the station (E. S. R., 35, p. 22) are reported to show the effects on the soil of different fertilizer treatments and of the crops produced.

It was found that there was a gain in nitrogen averaging 20 lbs. per acre per year on the plat receiving acid phosphate. On the plat on which acid phosphate and sulphate of potash were applied the gain in nitrogen amounted to 78 lbs. per acre per year. The phosphorus applied to the soil in excess of the needs of the crops was not lost in the drainage water, but was fixed in the surface 6⅝ in. of soil. Organic matter was maintained and increased by the use of fertilizers without plowing under green manuring crops or crop residues other than the stubble left behind after the crops were harvested. The use of quicklime in excess of the needs of the soil caused a loss of nitrogen, phosphorus, and organic matter from the surface soil considerably larger than the increased yields produced would justify. The use of manure or fertilizers (with the exception of sulphate of potash) had a tendency to decrease the acidity of the soil.

[Experiments in Java with green manures], W. M. van Helten (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Cultuurtuin, No. 2 (1915), pp. 32, pls. 4; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 2, p. 198*).—The author describes a number of plants (among others, *Tephrosia candida*, *T. hookeriana* var. *amœna*, and *T. vogelii*; *Centrosema plumieri*; *Clitoria cajanifolia*; *Desmodium gyroides*; *Indigofera hirsuta* and *I. sumatrana*; and *Crotalaria striata*) which gave good results when used as green manure in the experiment garden at Buitenzorg, especially after the alang alang (*Imperata* sp.) and weeds had been previously uprooted.

Experiments carried out at the experiment garden and in plantations of Java showed that "*T. candida* gave better results than the other plants used as green manure, especially in the Hevea, cacao, and tea plantations. *Clitoria cajanifolia* can be recommended as preventing erosion on sloping ground. *Cassia pumila* rapidly covers the ground and produces abundant foliage. It is to be recommended for young plantations of rubber trees and of tea shrubs in order to prevent erosion and the spread of weeds. *Cassia tora* has a subfrutescent habit and grows as well on the seaboard as in the mountains."

The author advises that the experiments be continued with *Tephrosia* sp., *Crotalaria muyussi*, *D. hirsutum*, and *I. villosa* by manuring crops other than those growing in the Buitenzorg experiment garden.

Loss of organic matter in green manuring, G. E. Boltz (*Mo. Bul. Ohio Sta., 1 (1916), No. 11, pp. 347–350*).—Plat and lysimeter experiments are described, in which green clover was added to the soil at rates of 7,744 and 17,520 lbs. per acre, being plowed under in two cases and left on the surface in two cases.

It was concluded that an accumulation of a large amount of organic matter does not take place as rapidly as is often assumed. "The loss of organic matter from a crop of clover which is cut and allowed to remain on the surface of soil for 206 days is practically the same as the loss of organic matter by

feeding." It is further concluded that organic matter is not lost so rapidly and more accumulates in the soil when it is incorporated in the soil than when applied to the surface.

The utilization of the nitrogen of manure in relation to the time of manuring the soil, A. SABASHNIKOV (*Selsk. Khoz. i Liesov., 249 (1915), Dec., pp. 499–512*).—The general question of the utilization of manure nitrogen by crops is discussed, and 11 years of experiments with rye and 4 years of experiments with wheat are reported which showed that larger increases in the rye crop were obtained when manure was plowed under in June than when plowed under in May. The opposite was the case with wheat. A decrease in the rye crop and the smallest increases in the wheat crop resulted from plowing under manure in April. It was further found that in years in which the summer and autumn were rainy and the rye grew thickly and was beaten down the following spring by wind or rain, manure lowered the yields.

Bat guanos, P. L. GILE and J. O. CARRERO (*Porto Rico Sta. Rpt. 1915, pp. 13, 14*).—On the basis of the results of analyses of 200 samples of bat guanos for nitrogen and phosphoric acid and experiments on the availability of the phosphoric acid of the guanos as compared with acid phosphate, bone meal, and basic slag it is stated that "the greater part of the guanos are to be considered as low-grade phosphatic fertilizers." The total phosphoric acid is very variable, ranging in the samples analyzed from 1 to 42 per cent.

"By vegetation tests it appears that if the availability of the phosphoric acid in acid phosphate is taken as 100 per cent, the effectiveness of the phosphoric acid in different guanos ranges from zero to 100 per cent. With most guanos the solubility of the phosphoric acid in neutral ammonium citrate parallels very closely its availability as determined by vegetation tests with corn and millet. As phosphatic fertilizers the guanos are equally effective for corn and millet. Most of the deposits contain but little nitrogen, although there is a small amount of material in nearly every cave, generally the first 2 to 3 in. of the deposits, that contains considerable nitrogen. The very fresh material that has undergone no decomposition may contain 10 to 11 per cent of nitrogen."

The availability of nitrogen in garbage tankage, J. P. SCHROEDER (*Amer. Fert., 45 (1916), No. 8, pp. 21–23*).—The results of pot culture tests on the availability of the nitrogen of garbage tankage are briefly compared with those obtained by the alkaline permanganate method. The conclusion is drawn "that a higher availability should be accorded the nitrogen in garbage tankage than that indicated by the permanganate methods."

Potash in Salduro salt deposit, H. S. GALE (*Engin. and Min. Jour., 102 (1916), No. 18, pp. 780–782*).—A brief description of the Salduro salt deposit on the western border of Utah is given, together with analyses of the salts and the brine from the Salduro salt marsh. The deposit covers an area of over 100 square miles and varies in thickness from 3 to 5 ft. The brine analyses show a potassium content of from 2.85 to 4 per cent of the dissolved salts or from 0.76 to 1.03 per cent of the original solution, which is said to be about half the potassium content of the Searles Lake brine and twice that of the Great Salt Lake water.

Action of calcium carbonate on acid phosphate, E. W. MAGRUDER (*Amer. Fert., 45 (1916). No. 8, pp. 30–32*).—Further experiments, similar to those reported by Brackett and Freeman (E. S. R., 34, p. 26) on the effect of mixing calcium carbonate in the shape of ground oyster shells with acid phosphate a month old and acid phosphate only a few days old, are reported.

It was found that new acid phosphate was acted on more readily by the oyster shells than the older acid phosphate, the reaction beginning at once and

increasing with time and the amount of oyster shells used. With 30 and 50 per cent of oyster shells virtually all the water-soluble phosphoric acid disappeared.

A critique of the hypothesis of the lime-magnesia ratio, I, II, C. B. LIPMAN (*Plant World, 19 (1916), Nos. 4, pp. 83–105; 5, pp. 119–135; abs. in Chem. Abs., 10 (1916), No. 16, p. 2118*).—A review of some of the more important investigations on the subject is given, leading to the conclusion "that in the first place there is little or no evidence in support of the necessity to plants for a proper lime-magnesia ratio in soils, which is specific for certain groups of plants. In the second place, when certain favorable effects are noted which appear to indicate that they follow from the adjustment of the ratio of lime to magnesia, such favorable effects can easily be explained on many other grounds which do not call at all for the introduction of the hypothesis of the lime-magnesia ratio."

The effect of some manganese salts on ammonification and nitrification, P. E. BROWN and G. A. MINGES (*Soil Sci., 2 (1916), No. 1, pp. 67–85*).—Experiments conducted at the Iowa State College with clay loam soil containing 0.1732 per cent manganese on the effect of the sulphate, chlorid, and nitrate of manganese and of manganous oxid on the ammonification of dried blood and the nitrification of ammonium sulphate when added to the soil at rates varying from 0.005 gm. to 5 gm. per 100 gm. of soil (100 lbs. to 100,000 lbs. per acre) are reported.

It was found that "manganese chlorid in applications greater than 2,000 lbs. per acre depressed both ammonification and nitrification, the depression increasing as the size of the application was increased until a point was reached at which both processes ceased. With smaller amounts of the chlorid the effects on the two processes were not identical but tended in the same direction. Thus the applications of 100 and 200 lbs. per acre gave increases which were slight in the case of ammonification but quite distinct in the case of nitrification. With amounts greater than 200 lbs. per acre and less than 2,000 lbs., however, ammonification was depressed while no appreciable depression was apparent on nitrification.

"Manganese sulphate when applied to the soil at the rate of 100 lbs. per acre increased appreciably both ammonification and nitrification. In amounts greater than 100 lbs. per acre and less than 2,000 lbs., ammonification was increased but to a smaller extent than with the 100-lb. application, but with nitrification no gains or depressions were found with these amounts. In applications equal to or greater than 2,000 lbs. per acre, both nitrification and ammonification were depressed by manganese sulphate, the depression increasing with the size of the application.

"Manganese nitrate added to the soil at the rate of 500 lbs. per acre or in greater amounts depressed both ammonification and nitrification, the depression increasing as the size of the application was increased. Manganous oxid when applied to the soil at the rate of 2,000 lbs. per acre or in larger quantities depressed both ammonification and nitrification, the depression becoming greater as the size of the addition was increased."

It is concluded that "if manganese salts in small quantities increase crop yields on a soil that increase may be due in part at least to a beneficial effect on ammonification and nitrification with a consequently greater production of available plant food. On the other hand, if manganese salts when applied to the soil restrict crop growth, that restriction may be due in part to a depression of bacterial activity."

Six references to literature bearing on the subject are appended.

Commercial fertilizers, P L. HIBBARD (*California Sta. Bul. 272 (1916), pp. 47–99*).—This bulletin reports the results of actual and guarantied analyses and valuations of 467 samples of fertilizers and fertilizing materials collected

for inspection in California during the fiscal year ended June 30, 1916. A list of registered dealers and manufacturers of commercial fertilizers in the State is also given.

Analyses of commercial fertilizers, P. H. WESSELS ET AL. (*Rhode Island Sta. Insp. Bul., 1916, Oct., pp. 3–18*).—This bulletin reports the results of actual and guarantied analyses of 101 samples of fertilizers and fertilizing materials collected for inspection in Rhode Island during 1916. "The absence of potash in over one-half of the brands and the small amounts in those brands that do carry potash are noticeable features of the fertilizer situation in 1916."

AGRICULTURAL BOTANY.

Department of botanical research, D. T. MACDOUGAL (*Carnegie Inst. Washington Year Book, 14 (1915), pp. 55–106*).—The groupings under which this work by numerous investigators is reported include equipment; photolysis, respiration, hydration, and growth; some special water relations of plants; environic relations; the Salton Sea and Mohave Desert regions; genetics; and various special investigations.

Some of the important results of this work considered as a whole are summarized by stating that plant growth takes place at the expense of definite or formative compounds, which are formed locally at a rate depending primarily upon the influence of temperature on chemical velocity. The processes may be masked or checked by imperfect respiration, enlargement depending upon conditions affecting water absorption. Light breaks down the smothering acids formed under incomplete respiration in cacti, thus facilitating the production of formative material. Lessened acidity due to light action conditions absorption of water, so that light may accelerate growth in two different ways. Auxographic instruments have been improved and glass screens of specialized transmissibility to light have been designed. The readily varying permeability of protoplasm is referred to the interrelations of the disperse phase and the disperse medium of the hydrophile emulsion colloids of which it is made up.

Sunlight is found to cause changes in air as a result of which respiration is highest on days of high solar radiation, less on cloudy days, and least at night. Arrangements are in progress for measurements of electrical conditions of the air under identical conditions. In a study of photosynthesis, formic acid has been produced from solutions of carbon dioxid and potassium carbonate, and exposure of formic acid to sunlight and ultraviolet light has produced a substance giving the reactions of a sugar and capable of use as food by green algæ in darkness.

Succulent plants under desiccation may show for a long time normal proportions of water content, owing to coincident respiration or oxidation of solid materials. While the proportion of nonreducing sugars in succulent plants increased during one to six years of starvation, that of hydrolyzable carbohydrates was decreased. The starvation phenomena, some of which persist for several years after restoration of normal conditions, include hydrolysis of cell walls, deformation and peripheral thickening of nuclei, and reduction of the protoplast. Cell sap density of the desert plants is least in species native to arroyos, and shows a scale ascending through those of canyons, rocky slopes, and bajadas to those of saline areas.

Plant successions which occupy an area originally bare finally culminate in a formation the nature and permanence of which are determined by climate. The history of terrestrial vegetation shows the four great eras, Eophytic, Paleophytic, Mesophytic, and Cenophytic. The chief physical factors and their

effects corresponding to various altitudes have been evaluated. The preliminary studies of the Mohave Desert region are considered to have made such advances as to condition progress in the interpretation of the origination, phylogeny, and successions of the present vegetation of this region. Studies of the rôle of the several factors in a desert complex are thought to prove that the more divergent part of a population is eliminated by environic agencies, but that this eliminating action is subject to various modificatons.

Artificial absorption of liquids by plants through their aerial parts, C. Acqua and Virginia Jacobacci (*Ann. Bot.* [*Rome*], *14* (*1916*), *No. 1, pp. 33–40*).—Having extended the studies previously reported by Acqua (E. S. R., 35, p. 331), the authors state that solutions of glucose were absorbed by aerial portions of young white mulberry trees and produced in very small plants a conspicuous increase in growth accompanied by morphological variations both external and internal, somewhat older plants being less affected, and still more developed ones showing very slight effects from this treatment. Lupines supplied through their aerial parts with potassium nitrate or magnesium phosphate showed a retardation of growth, and those given potassium or calcium nitrate began to show decay in about 11 days, the controls remaining normal. It thus appears that some solutions of salts having nutritional value when taken up through the roots are injurious when passing directly into the plant.

A study of physiological balance in nutrient media, J. W. Shive (*Physiol. Researches, 1* (*1915*), *No. 7, pp. 327–397, figs. 15*).—Results are given of experimental study of the growth made by plantlets of winter wheat in water cultures with respect to the physiological balance of salts and the total concentration of the medium. For each of the total concentrations employed corresponding to pressures of 0.1, 1.75, and 4 atmospheres, there were tested simultaneously 36 different proportions of the three nutrient salts calcium nitrate, magnesium sulphate, and potassium dihydrogen phosphate, a small amount of ferric phosphate being added to furnish iron. The criteria employed were total water loss by transpiration and guttation during growth, dry yield, water requirement of tops and of roots, apparent condition of tops, especially as to leaf injury, and condition of roots, especially as to lateral branching.

It is stated that within the first four weeks of growth these three salts form a nutrient medium well suited to the development of wheat plants when the total osmotic concentration is about 1.75 atmospheres and when the salts are present in either one of two somewhat similar sets of proportions which are given with discussion. These solutions are thought to be equal to any and superior to most of those of equal total concentration previously described and in general use. For a given total concentration the best physiological balance of salt proportions for tops is not the same as that for roots. The values of the cation atomic ratios magnesium : calcium, magnesium : potassium, and calcium : potassium appear to determine the growth in many cases, but this relation is not always clear for any single ratio.

Cases of injury to leaves are noted in connection with certain concentrations, also cases of root injury in connection with severe leaf injury.

Water loss during growth corresponds in a somewhat reliable way to top yields. While there appears to be no general relation between water requirement per gram of roots and total concentration for the optimal or suboptimal total concentrations, the water requirement per gram of dry tops varies in inverse order as regards the total concentration of the medium.

Influence of certain salts and nutrient solutions on the secretion of diastase by Penicillium camembertii, W. J. Robbins (*Amer. Jour. Bot., 3* (*1916*), *No. 5, pp. 234–260, figs. 3*).—The author describes a method of determining

diastatic action in solutions of soluble starch by the precipitation of the undigested starch and part of the dextrins in acid alcohol. An account is also given of the effects as to the amount of starch digested by *P. camembertii* which are produced by given concentrations of various salts. A contrast is noted between the rate of digestion of soluble starch by *P. camembertii* and *Aspergillus oryzæ* and the rate observed in the case of digestion by *Mucor rouxii* or *Fusarium* sp. While no evidence was found to connect potassium and calcium with diastase formation, it is thought that nitrogen may bear an intimate relation thereto in case of *P. camembertii.*

Nitrates in sulla (Heydsarum coronarium) and other legumes, GIULIA CAMPANILE (*Ann. Bot. [Rome], 14 (1916), No. 1, pp. 49–75*).—In the studies here outlined, employing chiefly *H. coronarium*, it was found that plants growing in a medium rich in nitrates absorbed these in a quantity somewhat larger than in ordinary soil, especially in case of the young plants. The distribution of nitrates in the plant at different periods is discussed. Data are also presented as obtained with *Lupinus albus*, these corresponding in a general way with those obtained with *Pisum sativum*, *Vicia faba*, and *V. sativa.*

Glucosid formation by plants, G. CIAMICIAN and C. RAVENNA (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 25 (1916), I, No. 1, pp. 3–7*).—In tests with maize and bean it was found that while pyrocatechin, gallic acid, and tannin were toxic to both these plants, saligenin was used by both, benzyl alcohol probably by bean, and hydroquinone apparently by maize. It is stated that substances resembling glucosids were formed in the young plants.

Studies on the presence and the physiological significance of the flavone derivatives in plants, I–III, K. SHIBATA, M. KISHIDA, and I. NAGAI (*Bot. Mag. [Tokyo], 29 (1915), Nos. 343, pp. 118–132, figs. 4; 347, pp. 301–308; 30 (1916), No. 352, pp. 149–178*).—In the first of these papers it is claimed that the flavone derivatives, probably as glucosids, were present invariably in the epidermal cell sap, and sometimes in the deeper structures, of the aerial parts of numerous plants examined. These substances are held to be of considerable physiological importance, probably in preventing injury from ultraviolet rays.

In part II, entitled The Chemical Biology of Alpine Plants, further experiments and observations are reported which are considered to support the conclusions stated in the preceding article. Flavone bodies were found to be among those occurring most commonly in plants, such as chlorophyll, sugars, and starches. They appear to be related to the penetrability of atmosphere to light, probably serving to protect the plant from the short ultraviolet wave lengths, in case of plants growing in tropical or high regions, and hence accessible to these shorter ultraviolet rays.

In part III, entitled The Flavone Content of Tropical Plants, a large body of studies carried out with very diverse plants in various parts of the world is said to confirm the conclusions above stated as regards the relation between flavone and protection from ultraviolet waves of solar origin. Flavone bodies and anthocyanin are said to pass reversibly the one into the other, the former being regarded as an important physiological factor in plant life. Some of the data are reported in tabular form.

Relation of oxidases and catalase to respiration in plants, C. O. APPLEMAN (*Amer. Jour. Bot., 3 (1916), No. 5, pp. 223–233*).—This information has already been noted from another source (E. S. R., 34, p. 523).

On the relation between transpiration and stomatal aperture, F. DARWIN (*Phil. Trans. Roy. Soc. London, Ser. B, 207 (1916), No. 343, pp. 413–437, figs. 23*).—The problem which furnishes the subject matter for the present paper, the relation between stomata and transpiration, has already been dealt with to

some extent (E. S. R., 27, p. 222; 31, p. 222). The results, as tabulated and plotted for the ivy, rubber tree, and laurel, are considered to afford convincing evidence that transpiration is regulated by stomatal aperture.

The perception of heliotropic stimulus in plants, Giulia Campanile (*Ann. Bot.* [*Rome*], *13* (*1915*), *No. 2, pp. 139–148*).—The author states that in studies with such plants as *Vicia sativa*, *Cicer arietinum*, and Diplotaxis, no constant relation was found to exist corresponding to that suggested in the work of Haberlandt (E. S. R., 31, p. 728) between the presence of certain lenticular cells and the perception of luminous stimuli. In *Colocasia esculenta* and *C. antiquorum* the perception of light stimulus appears to reside in a minute organ of the foliar lamina which is otherwise insensible to light. In case of some fleshy plants where such relation seems to exist, it is said that the reaction still occurs after removal of the epidermis.

The relation between geotropic sensitivity in roots to the presence and orientation of statoliths, Virginia Jacobacci (*Ann. Bot.* [*Rome*], *12* (*1914*), *No. 2, pp. 165–175*).—Concluding a study of *Cicer arietinum*, the author states that in case of this plant it appears evident that the presence, in the root tips, of starch grains as statoliths is associated with the reception of gravitational stimulus.

Recent studies on the relation of geotropic sensitivity in roots to the presence and orientation of statoliths, Virginia Jacobacci (*Ann. Bot.* [*Rome*], *13* (*1915*), *No. 2, pp. 149, 150*).—Having extended the study above noted to a number of other plants, the author states that the roots which were geotropic generally contained large numbers of statoliths. Results are given of such studies as carried out with *Cucurbita maxima*.

The vitality of seeds buried in the soil, W. J. Beal (*Proc. Soc. Prom. Agr. Sci.*, *36* (*1915*), *pp. 25–27*).—This report has already been noted from another source (E. S. R., 34, p. 732).

Mechanics of dormancy in seeds, W. Crocker (*Amer. Jour. Bot.*, *3* (*1916*), *No. 3, pp. 99–120*).—Discussing theories of longevity, causes of dormancy with methods of securing it, and forcing agents, the author states that dormancy in seeds results generally from the inhibition of one or more of the processes preceding or accompanying germination. Seed coats play an important part in both primary and secondary dormancy. Their colloidal nature permits their easy modification by even low concentrations of a variety of agents, such results having been frequently but wrongly interpreted as stimulus reactions. Regarding germination conditions for both seeds and pollen, it is thought that the recent trend of opinion is toward the need of general physical conditions and away from the need of specific chemical stimuli, or even chemical stimuli at all.

After-ripening of seeds or the changes during dormancy and finally controlling germination may involve growth of the rudimentary embryo, fundamental changes in an otherwise mature embryo, or chemical changes in the coats. In after-ripening, there is often a complex interrelation between coat and embryo changes.

Foliar structure in some oaks having persistent leaves, G. Donati (*Ann. Bot.* [*Rome*], *13* (*1915*), *No. 2, pp. 157–168, figs. 13*).—This is mainly a comparative study of leaf structure in *Quercus ilex*, *Q. suber*, *Q. occidentalis*, and *Q. coccifera*.

It is stated that the structure apparent in the study of an individual or of members of a given species varies with the age of the material and with the conditions of the examination. The leaf type in a given species, while varying somewhat as to its minor characters, is still fairly constant. Both internal and external structures of young trees resemble those of older ones of the same species. It is stated that while the foliar structures of *Q. ilex* and those of *Q.*

coccifera grown in sun and those grown in shade are much alike, the stem structure shows differentiation as to its characters.

Mesophyll structure and function in grains, G. CATALANO (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 25* (*1916*), *I, No. 2, pp. 112–117*).—Giving a brief account of studies on some typical leaf structures in gramineous plants, more particularly *Chloris gayana*, the author states that a sort of differentiation met with in green parenchyma which forms abundant yellow pigment but no starch indicates a degree of specialization in the foliar tissue corresponding to a division of labor in the general process of nutrition, with resulting economy of total resources.

The nature of the inflorescence and fruit of Pyrus malus, CAROLINE A. BLACK (*New Hampshire Sta. Tech. Bul. 10* (*1916*), *pp. 519–547, pls. 8; Mem. N. Y. Bot. Gard., 6* (*1916*), *pp. 519–547, pls. 8*).—A morphological study of *P. malus*, including the origin and development of the flower from the incipient shoot and the subsequent formation of the fruit. It deals in considerable detail with the flower bud and its position, the inflorescence, the flower and its essential parts, pollination and fertilization, and the development of the fruit itself.

It is stated that in the Baldwin apple, which was used in the study under discussion, the size of the fruit bud is not a distinguishing character. The fruit bud, rarely axillary, may occur in various positions, being identified with certainty only by dissection. The growth of the fruit bud is characterized by an elongation of the axis, in which wood is formed and upon which flowers, leaves, and buds develop. The bud scales are modified petioles. The inflorescence is a simple cyme. The flower parts develop in succession from the torus, the apex of the axis not being completely used up in the production of the flower parts.

The inferior ovaries are imbedded in the torus, which grows with the carpels. The mesocarp and exocarp of the carpels become fleshy and the endocarp cartilaginous or papery. The torus is the receptacle of the flower and its growth produces the flesh of the fruit, which exhibits a well-defined pith and a cortical layer which are delimited by ten primary vascular bundles, which give rise to the carpellary vascular system.

The fruit of the apple may be regarded as a reenforced or composite fruit consisting of one or more drupe-like fruits embedded in a fleshy torus.

The literature cited is listed.

Notes on parthenocarpy, B. LONGO (*Ann. Bot.* [*Rome*], *14* (*1916*), *No. 1, pp. 29–32, fig. 1*).—The author discusses briefly some observations made upon *Monstera deliciosa* and the so-called butter pear, both of which generally produce seedless fruits.

Department of experimental evolution, C. B. DAVENPORT (*Carnegie Inst. Washington Year Book, 14* (*1915*), *pp. 127–149*).—Among the principal advances in botany reported during the year are mentioned the discovery that in different strains of Lychnis there is a difference in the dominance of one and the same trait, hermaphroditism (including maleness); the proof that inheritance of determiners from both parents by certain plant hybrids leads to more prompt development of characters than in case of inheritance from one side only; the demonstration of a triple factorial basis for the foliage color of Lychnis; and the production of a strain of beans with double the number of cotyledons and first leaves of the seedling.

A new graft hybrid, A. MANARESI (*Staz. Sper. Agr. Ital., 48* (*1915*), *No. 5–7, pp. 513–524, pls. 4*).—An account is given of characters noted in a study of a hawthorn said to be a graft hybrid, the probable origin of which is reserved for later discussion.

Significant accuracy in recording genetic data, E. M. East (*Amer. Jour. Bot., 3 (1916), No. 5, pp. 211–222*).—This is a discussion of supposed disagreements between the statements of findings by the author as previously noted (E. S. R., 29, p. 216), and those made by Goodspeed and Clausen (E. S. R., 34, p. 225).

FIELD CROPS.

[Work with field crops], L. Smith (*Rpt. Agr. Expt. Sta. St. Croix, 1914–15, pp. 1–28, pl. 1*).—Experiments with sugar cane, cotton, and a number of minor crops are described.

Work with sugar cane included fertilizer experiments, cultural tests, comparisons of varieties and seedling canes, and bud selection. The fertilizer experiments conducted in several parts of the island showed, in general, that the use of commercial fertilizers can not be relied upon to increase the returns. This is considered as probably due to the small rainfall, which sets a low limit to the growth of the cane. In a series of cultural tests cane was grown in rows 4.5 ft. apart, at intervals of 2, 3, and 4 ft. in the row. The closest planting gave an increase in yield of cane of 20.7 per cent and the medium distance 15.5 per cent over the widest spacing. Three of five bud selections gave a higher yield than ordinary cane, both as plants and ratoons. The results of trials of imported and other varieties of cane are given in tables. Canes B. 4596, B. 6204, B. 7169, and Sealy Seedling are mentioned as giving particularly good results.

Tests of 21 Sea Island cotton selections showed a range in yield of from 208 to 690 lbs. of seed cotton per acre. A 3-acre plat of the first generation hybrid, Sea Island × Sakellarides, planted the middle of August, yielded 3,139 lbs. of seed cotton with the quality equal to that of good Sea Island. The first generation hybrid, Sea Island × St. Croix Native, which was promising a year ago, turned out a complete failure on account of boll dropping.

Cultural tests of maize, imphee, alfalfa, velvet beans, Sudan grass, sorghum varieties, and spineless cactus are briefly noted.

[Fertilizer experiments], A. W. K. de Jong (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Agr. Chem. Lab., No. 13 (1915), pp. 27*).—The results of fertilizer experiments with cassava, rice, and citronella grass are reported and briefly discussed.

It was found that as compared with sulphate of ammonia nitrate of soda was taken up more readily by cassava plants. Lime nitrogen as a fertilizer for rice was practically as effective as sulphate of ammonia, while molasses produced no advantage. The use of sulphuric acid applied on rice fields did not appear to produce an injurious effect on the yield. A relatively insoluble phosphate and double superphosphate applied in the ratio of 3:1, respectively, as fertilizers for rice were about equally effective. Volcanic rock used as a fertilizer on citronella grass produced no effect, while a complete fertilizer application gave the largest increase of the different fertilizers tested.

Contributions to the principles of breeding certain agricultural plants.—V, Grasses, C. Fruwirth (*Naturw. Ztschr. Forst u. Landw., 14 (1916), No. 3–4, pp. 127–149*).—Continuing previous work,[1] this article discusses observations on the conditions of blossoming and experiments in fertilization of the more important agricultural grasses, including species of Dactylis, Poa, Festuca, and Lolium, together with *Phleum pratense*, *Alopecurus pratensis*, *Avena flavescens*, and *Arrhenatherum elatius*.

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[1] Naturw. Ztschr. Land u. Forstw., 1 (1903), No. 10, pp. 397–404; 2 (1904), Nos. 1, pp. 18–47; 6, pp. 241–253; 4 (1906), No. 1, pp. 50–55, pl. 1.

In summarizing the results the author states that the grasses studied have their main blossoming stage between five and nine o'clock in the morning, with the exception of *Lolium perenne* and *L. italicum* which blossom a little later, or between ten and twelve o'clock. The blossoming of an individual floret generally lasts from one to two hours, seldom less than one hour but often longer than two hours. No marked difference in this respect among the different species was established.

Blossoming was observed to begin in the upper third of an inflorescence, and in the branches of panicles the flower at the point was the first one to open. With the exception of *Poa pratensis*, the blossoming began with the lowest floret and proceeded upward. It was found that on the average the earlier blossoms produced the heavier fruits. Weather conditions prevailing on a certain day, or even the day preceding, were found to exert a marked influence on the beginning of blossoming and the number of blossoms opening. A retarding effect of the weather gave rise to a larger number of opening blossoms on the day following.

Experiments in the artificial control of temperature, light, and moisture showed that temperature was of much greater importance in its effect on blossoming than the other two conditions. With insufficient temperature blossoming did not take place, but with the proper temperature conditions it was only slightly retarded by the absence of light. High atmospheric humidity did not interfere with blossoming, although it held back the opening of the pollen sacks.

Single blossoms of different grasses inclosed in cotton batting did not produce seed-containing fruits. Similarly inclosed single inflorescences, in the case of only a few grasses, yielded negligible quantities of germinable seed, and two inflorescences from an individual plant produced sexually and inclosed together yielded some fruits which did not germinate and others, somewhat greater in number than those secured from the singly inclosed inflorescences, which were capable of growth. Entire sexually-produced plants when inclosed did not, in many instances, yield a single germinable seed, in others only a small number, and in a few cases a larger number. *L. perenne*, *L. italicum*, and *P. elatius* exhibited the greater tendency toward self-fertilization. The great differences in the behavior of plants of the same species under this treatment are ascribed to individual differences.

Divisions of sexually produced plants inclosed together resulted in a number of cases in the development of a satisfactory number of germinable seeds. The progressive results secured in this series of experiments are considered due to the greater chances of pollination in any particular test as compared with the preceding one.

Experiments with divisions of an individual plant of *A. elatius* showed that complete self-sterility occurs in some grasses. For two years in succession 297 such divisions planted 40 cm. apart each way did not produce any germinable seed.

Some common grasses and how to know them, R. S. MacDougall (*Trans. Highland and Agr. Soc. Scot., 5. ser., 28 (1916), pp. 56–91, figs. 28*).—This paper describes the root, stem, leaf, flower, fruit, and seed of a grass plant, defines the terms used for descriptive purposes, gives a detailed description of each of the more important grasses together with keys in tabular form for their identification, and points out how the seeds of different species may be recognized.

Eleven references to literature on grasses are cited.

A trial of grass mixtures, F. W. Hilgendorf (*Jour. Canterbury Agr. and Past. Assoc., 3. ser., 4 (1916), pp. 28–34, figs. 5*).—A comparison was made on land of medium fertility of grass mixtures consisting principally of Italian

rye grass, perennial rye grass, cocksfoot, timothy, meadow fescue, red clover, and white clover. The third year after seeding, the seasons of the second and third year having been dry, the Italian rye grass had entirely disappeared, the perennial rye grass had greatly decreased in importance, and the cocksfoot had increased. It was shown that in general an increase in cocksfoot resulted in a decrease of bare land. Timothy and meadow fescue, believed to require heavier land and more moisture than was available during this experiment, were not successful.

Composition of several of the forage grasses of German East Africa, M. REICH, F. HONCAMP, and H. ZIMMERMANN (*Landw. Vers. Stat., 87 (1915), No. 4–5, pp. 351–363*).—The samples of grasses analyzed, selected in the region between the Pare Mountains and the Pangani River, included the following species. *Eragrostis superba, E. minor (?) Pappophorum scabrum, Sporobolus spicatus, S. robustus, S. rehmanii, Aristida adscensionis, Cynodon plecto stachyum, Chloris virgata, C. myriostachya, C. geryana, Dactyloctenium ægyptiacum, Leptocarydium, alopecuroides, Digitaria horizontalis,* and *Pennisetum ciliare.* Each grass is briefly described and the chemical composition, including the organic and inorganic constituents of the sample representing it, is reported.

Medicago falcata, a yellow-flowered alfalfa, R. A. OAKLEY and S. GARVER (*U. S. Dept. Agr. Bul. 428 (1917), pp. 70, pls. 4, figs. 23*).—This bulletin deals with the history, literature, and certain experimental work relating to *M. falcata*, a yellow-flowered alfalfa, and is an effort to correct extreme and erroneous opinions regarding this plant, setting forth reliable data for the aid of plant breeders and others interested in the species.

The first recorded introduction of *M. falcata* into the United States was by this Department in 1897, followed by importations in 1906 for the purpose of utilizing the species as a cultivated forage crop and by many subsequent introductions, mostly from Russia and Siberia. The species is thought to be indigenous over a large portion of Europe and the western two-thirds of Asia. It occurs throughout a wide range of soil and climatic conditions and at depressions and elevations ranging from below sea level to 13,000 feet above, thus possessing a much wider adaptation than *M. sativa.*

The botanical history of the species has been traced back to the early days of modern botany and is dealt with in some detail. Recent workers differ with regard to the taxonomic relationship of *M. falcata* to *M. sativa*, some regarding it as a true species, while others regard it as a variety or subspecies of the latter. That their relationship is quite close, however, is shown by the readiness with which they hybridize and the fertility of the hybrids.

A classification of the species has been attempted, based largely on the habit of growth. Owing to the extreme variability encountered, many forms are difficult to classify, possessing combinations of characters which make it difficult to determine whether they are of pure or hybrid origin. Four groups have been established, ranging in habit from prostrate to almost erect. Two groups are referred to as pasture groups, not being sufficiently erect to be harvested for hay, and the other two as hay groups.

This species has never been extensively cultivated in Europe or Asia, although utilized to some extent as a wild forage plant. It is now being cultivated to some extent in India and possibly to a still more limited degree in southeastern Russia and Chinese Turkestan.

The erect forms of *M. falcata* resemble those of *M. sativa* in their mass effect, but usually produce a heavier yield in comparison with their bulk, due to the large number of stems. The best strains of *M. falcata* frequently outyield the best strains of *M. sativa* for the first cutting of the season, but *M. falcata* is

seriously deficient as a forage crop in its inability to recover quickly after cutting. Further handicaps of this species as a cultivated crop are that in the West and Northwest, where it appears to hold greatest promise, it can be depended upon to make only one crop a season and that it produces seed sparingly and does not retain its seed as does *M. sativa*.

The natural distribution of the species, its adaptations, and its behavior under field conditions indicate that it is hardy and drought-resistant. Chemical analyses reported indicate that it is about as valuable for feeding purposes as the common alfalfas. The cultural requirements are much the same as those of *M. sativa*, although on account of its hard seed and the slow growth of the young plant it is difficult to secure a satisfactory stand. The plants of *M. falcata* bear transplanting better than do those of *M. sativa*. Sowings on unbroken native sod land gave fair stands, but the plants are not aggressive enough to be of any real value in this respect.

The greatest value of the species appears to lie in the field of selection and hybridization with *M. sativa*. It is hoped that superior strains of alfalfa can be developed from such hybrids.

A list of 67 articles is given, which comprises the literature cited.

Lucerne inoculation experiment, J. O. HEINRICH (*Agr. Gaz. N. S. Wales, 27* (*1916*), *No. 5, pp. 305–313, fig. 1*).—The results of four years' inoculation experiments with alfalfa indicated that inoculation with soil from a successful alfalfa field and of the same composition as the land being treated is much more efficient than the use of pure cultures, and that lime greatly increases nodule formation. Pure cultures of the vetch organism were ineffective for alfalfa. In these experiments inoculation without manure gave a lower yield than the check tests, while the plat limed but not inoculated gave the highest yield.

Alfalfa conditions in New England, H. W. JEFFERS (*Agr. of Mass., 63* (*1915*), *pp. 144–160*).—A popular article with discussion on the culture of alfalfa in New England.

Barley improvement, F. A. SPRAGG (*Michigan Sta. Circ. 32* (*1916*), *pp. 3–11, figs. 5*).—This circular gives the results to date of variety tests of winter barley in Michigan. Two varieties, Michigan Winter and Derr Winter, seem to give promise for the future, with average yields at the station for the seasons of 1913–1915 of 58.9 and 51.7 bu., respectively. The effect of climatic conditions upon winter barley is shown by numerous reports from farmers.

Fasciation in maize kernels, T. K. WOLFE (*Amer. Nat., 50* (*1916*), *No. 593, pp. 306–309, figs. 3*).—This paper from the Virginia Experiment Station describes two corn kernels, each with two embryos, occurring on an ear representing a cross between Improved Leaming as the seed parent and Boone County Special as the pollen parent, together with their progeny in the F_1 generation.

Two stalks were produced from each kernel and the four ears secured showed Mendelian splitting with reference to white and yellow kernels. All the kernels had only one embryo.

Work of the Pskof experiment station for flax culture, N. A. D'IAKONOV (*Selsk. Khoz. i Liesov., 249* (*1915*), *Sept., pp. 35–60; Oct., pp. 173–186*).—Determinations of the moisture content of fiber flax made at this station showed that under otherwise equal conditions the lower quality of flax has the higher moisture content. Fiber from single dry-stemmed plants was found to contain 84.24 per cent of dry cellulose, while green branched stems contained 81.43 per cent. The results further indicated the value of mass selection of long, single-stemmed plants in improving the quality of the crop. The retting of flax under controlled conditions and with the use of pure cultures of *Bacillus*

granulobacter pectinovorum is described. A better yield was secured in a test from seeds stored for more than a year than from fresh seed from the last harvest.

A handbook of industrial plants in common use, C. G. FARNSWORTH ET AL. (*[Phillipine] Bur. Ed. Bul. 54 (1915), pp. 111, pls. 24, figs. 49*).—This handbook briefly describes the industrial fiber plants of the Philippine Islands with reference to their botanical and other characters, distribution, habitat, and utilization.

Oat breeding experiments, J. T. PRIDHAM (*Agr. Gaz. N. S. Wales, 27 (1916), No. 7, pp. 457–461, pl. 1*).—The breeding experiments with oats here reviewed included mainly cross breeding and selection work with the Algerian variety to increase the height of the straw and to improve the grain from a feeding standpoint. The principal high-grade strains secured in this work are briefly noted, and yields obtained in a comparative test of varieties are reported.

A study of a cross between Algerian and Carter Royal Cluster showed that pigment in the straw behaved as a Mendelian character. In a variety test conducted from 1912 to 1915, inclusive, Algerian ranked first among four varieties with an average yield of 35.99 bu. per acre.

Observations on potato culture, V. G. KOTELNIKOV (*Selsk. Khoz. i Lîesov., 250 (1916), Apr., pp. 593–603*).—Seed tubers of medium size were planted in alternate rows, one and two in a place. The varieties grown were Six-weeks Imperial, and Always Good. Planting two tubers per hill gave a yield 15 per cent greater than the yield from planting only one tuber in a place. The use of large tubers for seed gave somewhat larger yields and a larger percentage of large tubers, but these advantages were not sufficient to offset the profits derived from the use of the smaller tubers.

The influence of overabundant soil moisture during the latter part of the growing season on potato tubers and their starch content, M. P. ARKHANGELSKIĬ (*Selsk. Khoz. i Lîesov., 250 (1916), Mar., pp. 400–406, figs. 3*).—Studies in progress for two years indicated that the capacity of resisting the malformation of tubers in the presence of an abundance of soil moisture is a heritable character, and showed that tubers of regular shape may have a starch content almost 4 per cent higher than tubers with outgrowths induced by too much soil moisture.

Further experiments in crossing potatoes, J. H. WILSON (*Trans. Highland and Agr. Soc. Scot., 5. ser., 28 (1916), pp. 33–55, figs. 12*).—This article describes a number of varieties of potatoes derived from varieties described in an earlier report on this work, previously noted (E. S. R., 19, p. 333). The characters and quality of the different varieties of crosses are set forth, and the behavior of seed sent out for trial is briefly reviewed.

Harvesting and storing potatoes, L. MALPEAUX (*Vie Agr. et Rurale, 6 (1916), No. 40, pp. 238–244, figs. 5*).—This article discusses the time and methods of harvesting potatoes and storing the crop, describes storage in cellars and pits, points out briefly the utilization of diseased or otherwise injured tubers, and reports the results of studies on the influence of methods of storing potatoes on their composition. It was found that, in general, storing in cellars was preferable to storing in pits, as there was a smaller loss of dry matter and starch, and the tubers were also in other ways of better quality for table use. The composition of lots of tubers stored for two, four, and six months in cellars and in pits is given in tables.

The soy bean, with special reference to its utilization for oil, cake, and other products, C. V. PIPER and W. J. MORSE (*U. S. Dept. Agr. Bul. 439 (1916), pp. 20, figs. 3*).—This bulletin is a general review of soy-bean production, intended to be of special interest to southern farmers and cotton-oil mill men,

as well as to farmers of the Northern and Central States and the manufacturers of soy-bean food products. Soy-bean production in Manchuria, Japan, Europe, and the United States is discussed in turn, and statistics presented relative to the quantity and value of the exports and imports of the soy bean and its products. The methods of oil extraction are described. Of the two methods commonly used in the United States, the hydraulic and the expeller processes, the latter is the more efficient and cheaper. The uses of soy-bean meal as human food and as stock feeds are discussed and comparative analyses given of soy-bean meal and other important oil meals. The uses of soy-bean oil in various commercial processes and for human consumption are also discussed.

Analyses of over 500 varieties of soy beans grown at Arlington, Va., show that considerable variation exists, the oil ranging from 11.8 to 22.5 per cent and the protein from 31 to 46.9 per cent. The yellow-seeded varieties are deemed most suitable for oil and meal production, and the Mammoth Yellow variety is most generally grown in the South for oil production. Environment appears to be a potent factor in the percentage of oil, wide variations being found in the same variety grown in different localities. Analyses of varieties reported from various sections of the United States indicate that a higher percentage of oil is obtained from the same variety produced by southern-grown seed. Similar results are said to have been obtained in Manchuria. Considerable variation in the percentage of oil was also noted in individual plant selections at Arlington, Va., indicating that improvement may possibly be secured by breeding.

The possibilities of developing a manufacturing industry with American-grown soy beans, especially in regions infested with the cotton-boll weevil, or subject to the danger of infestation in the future, are discussed.

Tobacco growing in the Connecticut River Valley, L. R. SMITH (*Agr. of Mass., 63 (1915), pp. 266–279, pls. 4*).—Historical notes on tobacco growing in the Connecticut River Valley and general directions for the culture of the crop in that section are given. The cost of raising one acre of tobacco is estimated at from $174 to $204, and it is stated that the cost of shade-grown tobacco is about 45 cts. per pound.

Improvement of Ghirka Spring wheat in yield and quality, J. A. CLARK (*U. S. Dept. Agr. Bul. 450 (1916), pp. 19, figs. 7*).—Among the Russian wheats imported for trial in the dry portions of the Great Plains area, Ghirka Spring wheat has proved to be productive and drought-resistant but low in quality when compared with the standard wheats for that region. The object of these experiments, therefore, was to improve the yield and quality of Ghirka Spring wheat.

A brief history and description of the wheat is given. The experiments were conducted with only one of the Department introductions, Ghirka Spring (C. I. No. 1517) from Grodno Province in Russian Poland. The experimental data include tests of yield, quality, and improvement at several points in South Dakota, North Dakota, and Montana, as well as milling and baking tests conducted at the North Dakota Experiment Station. Much of the data is reported in tabular form and discussed.

The general conclusions drawn from the experiments are as follows: Ghirka Spring wheat is a valuable drought-resistant variety, but is susceptible to rust in moist seasons and in humid areas. It yields on an average more than the Rysting Fife and Haynes Bluestem common wheats, but less than the Kubanka durum wheat. The quality of Ghirka, however, is inferior to that of all the three standard wheats named. Pure line selections numbers 4, 5, and 66 have proved superior to the other selections and to the original unselected mass variety, and compare favorably with the standard spring wheats of the Great

Plains area in both yield and quality. The selections may also prove valuable as material for crossing with varieties possessing greater rust resistance and higher quality.

Red Rock wheat, F. A. SPRAGG and A. J. CLARK (*Michigan Sta. Circ. 31 (1916), pp. 3–7, figs. 3*).—This circular is an extension of Bulletin 268 (E. S. R., 28, p. 141), continuing the results given in that publication up to 1916. Red Rock is especially recommended for Michigan for its winter hardiness, high yield, stiff straw, and its high quality for bread.

Methods of sowing Poltavki spring wheat, A. L. GOLODETS (*Bezenchuk. Selsk. Khoz. Opytn. Sta., No. 63 (1915), pp. 40*).—In experiments with Poltavki spring wheat sown broadcast and in drills 10.5 and 14 in. apart, the drilled seed came up better than that sown broadcast. The wheat in drills 14 in. apart made a more vigorous and leafy growth than that in drills 10.5 in. apart, but in quality was not quite so good, as the grains were smaller and not so well filled out. The soil moisture at the time the heads were forming was the higher in the field with the wider spacing in the drills. A test of different rates of sowing gave the best results from the use of 7 pood per dessyatine (about 1.5 bu. per acre).

Nitrogenous fertilizers in wheat culture, L. MALPEAUX (*Vie Agr. et Rurale, 4 (1915), No. 46, pp. 416–418*).—The results of experiments are reported on the use of nitrate of soda and sulphate of ammonia, applied singly or in combination and in varying quantities and on different dates as fertilizers for wheat. Applications were made on the fifteenth day of each of the months of November, December, January, February, March, and April. The best results were obtained from the applications made in February and March. The yields of grain and straw obtained on the different plats in the various series are tabulated.

A seed-testing key, A. H. COCKAYNE (*Jour. Agr. [New Zeal.], 13 (1916), No. 2, pp. 129–131*).—Tables compiled from analyses and tests of some 10,000 samples of seeds during the past four years, and giving the progressive average germination of the principal kinds of seeds sent in, are presented for the purpose of indicating the final germination and value of a particular lot of seed when the percentage of germination on a given day after the beginning of the test is known.

Contribution to testing the germination of grass seeds, F. KLING (*Jour. Landw., 63 (1915), No. 4, pp. 285–343*).—This article discusses the development of seed control work and its present status, the process of germination and the conditions which influence it, and the methods of making purity determinations and germination tests, and reports the results of germination tests with 14 species of grasses.

The tests conducted showed that while most of the seeds of some grasses germinated in about ten days, the seeds of other grasses required from three to four weeks. In summarizing the results, the grouping of the more important meadow grasses according to the yearly periods of principal development after seeding, as given by other investigators (E. S. R., 28, p. 632; 32, p. 330) is briefly outlined.

The results further indicated that the grasses developing early and quickly also germinate in shorter periods than those reaching full development later. The author bases the following grouping on the time required for germination: (1) Short germinative period, *Phleum pratense*, *Avena elatior*, *Bromus mollis*, *Agrostis stolonifera*, *Lolium italicum*, *L. perenne*, *Festuca pratensis*, and *Dactylis glomerata*; (2) medium germinative period, *Holcus lanatus*, *Alopecurus pratensis*, *Anthoxanthum odoratum*, and *F. ovina*; (3) long germinative period, *Cynosurus cristatus* and *Poa pratensis*.

With reference to methods of conducting germination tests it is concluded that germinating between blotting papers is best for most kinds of grass seed and that light is necessary for the germination of the seed of some species. A constant temperature of 20° C. without light was suited to the germination of only a few grasses, but a change of temperature from 20° for 18 hours to 30° for 6 hours gave good results with many different kinds. A constant temperature of 30° proved unsuited for grass seed germination. *A. pratensis* and *F. pratensis* germinated in the light and also under the temperature changes, and it is suggested that in seed control work both these methods be applied in testing the seeds of these species.

[The examination of beet seeds], M. Heinrich (*Landw. Vers. Stat., 87 (1915), No. 6, pp. 381–394*).—Four methods of beet seed examination for the purpose of securing samples for making germination tests, referred to as the count, weight, count-percentage, and count-weight methods, respectively, are described, and tests of the relative reliability of the methods are reported. The sources of error are discussed and means for the reduction or elimination of inaccuracies are proposed.

The size relation between dry and soaked seed of clover and dodder, M. Heinrich (*Landw. Vers. Stat., 87 (1915), No. 6, pp. 395–408*).—This article reports the results of measurements of air-dry and soaked seeds of clover and dodder, compares the differences in size, and points out how soaking may be employed in the removal of dodder seeds.

It was observed that air-dry red clover seed from different sources showed differences in the average measurements which disappeared in part when the seed was soaked. Seed of *Cuscuta trifolii*, when air-dry, was clearly distinguishable from red clover, white clover, and alsike clover seed on account of its smaller size, while air-dry seed of *C. suaveolens* was found also perceptibly smaller than seed of red clover but of equal size with seed of white clover and alsike clover. Soaking increased size differences between the seeds of clover and dodder to such an extent that a difference in size between the seeds of *C. suaveolens* and those of white clover and alsike clover was also plainly perceptible. A method for the removal of dodder seeds from lots of clover seed by means of soaking is described.

[Cooperative experiments in weed eradication] (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 41 (1915), pp. 16, 17; Rpt. Min. Agr. Ontario, 1915, pp. 18, 19*).—The results of four years' cooperative experiments in weed eradication showed that perennial sow thistle and twitch grass may be eradicated by good cultivation followed by rape sown in drills rather than broadcasted. As compared with buckwheat, rape was the more satisfactory for use in destroying twitch grass. It is further stated that deep cultivation in fall and spring followed by a well-cultivated, hoed crop will destroy bladder campion. Mustard may be prevented from seeding in oats, wheat, and barley by spraying with a 20 per cent solution of iron sulphate without any serious injury to the crop or the fresh seedings of clover.

[Pteris aquilina.—Life history and eradication], G. P. Gordon (*Trans. Highland and Agr. Soc. Scot., 5. ser., 28 (1916), pp. 92–106, figs. 11*).—The distribution, including the extent and method of spreading, the life history, and the nature of the damage due to the growth of this plant is described, and the results of experiments to determine the best methods for its eradication are reported.

It was found that the plants propagated mainly from the rhizomes, and that spraying them with a 5 per cent solution of sulphuric acid as compared with cutting the plants results in their destruction with greater economy and effi-

ciency. It is recommended that in a normal season the spraying be done early in July and again early in August. The cost of cutting was approximately three times the cost of spraying.

HORTICULTURE.

Report of the horticulturist, C. F. KINMAN (*Porto Rico Sta. Rpt. 1915, pp. 25–29, pl. 1*).—Investigations with fruits, vegetables, and miscellaneous plants were continued along lines previously noted (E. S. R., 33, p. 535).

In the cooperative fertilizer experiments with bearing coconut trees marked gains in yields were recorded for the complete fertilizer plats. Where 10 lbs. per tree of a mixture containing 6 per cent nitrogen, 8 per cent phosphoric acid, and 12 per cent potash was applied a gain of over 30 per cent in yield of nuts per tree over the check plat was obtained. Where 20 lbs. of the mixture was applied per tree the gain in yield of nuts per tree was 60 per cent. Where nitrogen or potash was omitted, no increase in yield was recorded. With the omission of phosphoric acid, there was only a slight increase. The average diameter of the nuts from the different plats has varied but little since 1912, when the experiments were started. Cooperative fertilizer experiments with young coconut palms were commenced during the year.

Thirteen varieties of the imported mangoes in the station orchard fruited during the year and are here listed. Of these, Cambodiana has for several seasons given the most promise for home planting, both from the standpoint of yield and quality. The variety Alphonse, or Bennet, was promising for commercial use during the past year, whereas the formerly promising variety Amini gave poor results, both as to yield and size of fruit. Sandersha continued to be the most prolific variety for use in making preserves or chutney. Observations on the quality of fruit and seedling growth of different wild types found in abundance have shown them to be inferior to the East Indian varieties, both as to the edible and the keeping qualities of the fruits. The slower growth of the wild seedlings makes them less satisfactory than seedlings of the introduced types for use in grafting and inarching. Germination tests of common Porto Rican mangoes show that the best results are secured when the husk is removed entirely from the seed before planting.

The tests to determine the influence of the Porto Rican conditions on northern varieties of vegetables, here summarized, are noted below.

The Smooth Cayenne pineapple, the commercial variety of Hawaii, has not proved satisfactory for general culture in Porto Rico. The algaroba tree (*Prosopis juliflora*) introduced from Hawaii has succeeded well in the southern part of Porto Rico, where the rainfall is light and the soil is sandy.

The bean *Canavalia incurva*, cultivated as a vegetable in a number of Asiatic countries, made poor growth and yield as compared with the jack bean (*C. ensiformis*), and the brown and purple seeded types of *C. gladiata* commonly grown in Porto Rico. The bean *Botor tetragonoloba* from the Philippine Islands has been very thrifty and prolific, although not so rich in quality as many common garden varieties of beans. The vines have large leaves and showy blossoms and are adapted for protecting verandas. A cowpea introduced from India appears to be well suited to conditions in Porto Rico and more valuable as a soiling or cover crop than the types commonly grown.

Experiments on the supposed deterioration of varieties of vegetables in Porto Rico, with suggestions for seed preservation, C. F. KINMAN and T. B. MCCLELLAND (*Porto Rico Sta. Bul. 20 (1916), pp. 5–30, figs. 11*).—This paper gives the results in detail of several years' study on the question of the supposed deterioration of varieties of vegetables when grown through several generations in the Tropics.

In conducting the experiment seed of a number of common garden vegetables which had been grown in the North was imported. A portion of the imported seed was kept in viable condition until the experiment was concluded or until the seed was used up by placing it in closed jars which were kept dry by placing in the bottom a few ounces of calcium chlorid. The imported seed and home-grown seed from succeeding generations were planted in beds which were side by side. In order to eliminate as far as possible the factor of varying weather conditions simultaneous plantings were made of as many different generations as possible.

Plantings made of peppers, such as are commonly grown in Porto Rico, side by side with varieties imported from the North showed that the Porto Rican types are much more productive and therefore more desirable than imported varieties. In forty plantings of beans, including nine generations, no indications that advanced generations were inferior to earlier ones were observed. As a rule plantings made in March gave large crops, while those made in other months, including June, September, November, December, and January, gave small crops. During a period of five years thirty-two plantings of okra were made, including eight generations, without any deterioration in the growth and production of the advanced generations. Similar results were secured with tomatoes. In the work with lettuce no degeneration was noted for successive generations, but owing to the difficulty of producing seed during seasons of heavy rain and because of the rapid loss of viability in the seed, it is believed that it will be necessary to import the seed of this crop. In all vegetable plantings the season at which the planting was made had a very pronounced effect on the yield, it being the predominant factor influencing production.

The results are given of germination tests of seed exposed to the air and of seed kept in containers with calcium chlorid. The method of preserving the seed by using calcium chlorid as a drier was so satisfactory that it is recommended for general use.

Managing the orchard, J. G. Moore (*Wisconsin Sta. Bul. 269 (1916), pp. 47, figs. 26*).—A treatise on orchard management with special reference to Wisconsin conditions. Information is given relative to selection of soils and sites, planning the orchard, varieties, planting operations, pruning the young trees, soil management, cover crops and fertilization, pruning the bearing orchard, and spraying practices for different fruits.

Winterkilling of peach buds, P. Thayer (*Mo. Bul. Ohio Sta., 1 (1916), No. 10, pp. 311, 312*).—Tabular data are given showing the records of observations made in the spring of 1914 and that of 1916 with respect to the amount of winterkilling found in the variety orchard at the station.

The observations, as a whole, indicate that the buds on young trees are more apt to be injured than those on mature trees. Winter hardiness does not mean so much resistance to low temperatures as it does resistance to the effects of the January thaw, which starts the buds into life, thus leaving them susceptible to the next moderately cold snap. Varieties appear to behave differently under various conditions. The relative hardiness of varieties for a winter continuously cold may be extremely different from that for a favorable winter.

Practical fig culture in Arizona, W. H. Lawrence (*Arizona Sta. Bul. 77 (1916), pp. 43, pl. 1, figs. 15*).—This bulletin includes the results of a general field survey of fig culture in Arizona, together with the results of cultural investigations conducted by the station. With the results of the survey and investigations as a basis, directions are given for growing figs, including information relative to the various classes of figs, method of fruiting, climatic requirements, soil, selecting varieties, propagation, arrangement of varieties in the

orchard, planting and care of the young orchard, pruning the bearing trees, cultivation and irrigation, winter protection, caprification, splitting and souring of the fruit, and pests.

Tabular data are given showing the altitude, temperature, and rainfall conditions in sections of Arizona where the fig is grown. Observations and data are also given on the present status of fig culture in different parts of the State and on the growth and condition of 60 trees, representing 43 horticultural forms, that have been under observation for three consecutive seasons, together with yield records of some varieties growing at the station.

During the process of harvesting the 1915 crop the specimens of many varieties were observed to gradually decrease in size with each subsequent picking. In some varieties the size of the fruit decreased during midseason, again increasing in size with subsequent picking. In others, there was an increase in the size of the fruit during the season. There was also a variation in the number of crops produced for the year. One, two, and three crops were produced by different varieties, the number being determined very largely by low temperatures occurring during the winter.

The fruit of the crop of figs, commonly known as Brebas, which is developed in the autumn on the tips of young wood, passes the winter on the naked branches of the trees, and matures the following spring, is usually of good size and can be distinguished from the second and third crops by its position on the wood of the previous season. A study of the varieties of figs grown in the Salt River Valley shows the most hardy and prolific varieties to be Lob Injir, Bulletin Smyrna, Black Mission, Black Adriatic, Bardajic, Rose Blanche, Dauphine, and Ronde Violette Hative. Several other varieties are also recommended for culture.

As a result of the study as a whole the author concludes that the proper selection of varieties will make fig culture possible in a wide range of climatic, water, and soil conditions, such as cover a large proportion of the agricultural area of Arizona.

The chemical composition of American grapes grown in the Central and Eastern States, W. B. ALWOOD ET AL. (*U. S. Dept. Agr. Bul. 452* (*1916*), *pp. 20*).—The present report is supplementary to a bulletin giving the results of analyses during the period 1908 to 1910, previously noted (E. S. R., 26, p. 441).

The analyses as here presented include the results for 1911 and 1913, a number of additional grape districts and varieties, including the Rotundifolia grapes from North Carolina, being covered by the work. In addition to detailed tabular data the results for sugar and acid determinations of practically all of the varieties examined during the five years' work are summarized.

Report of the assistant horticulturist, T. B. MCCLELLAND (*Porto Rico Sta. Rpt. 1915, pp. 30–33, pl. 1*).—A progress report on the station's work with coffee, cacao, and vanilla (E. S. R., 33, p. 536).

The testing of foreign varieties of coffee was continued on a larger scale. Additions during the year included the Bourbon and Quillou varieties, several new strains of Robusta, and seeds from selected individuals. Seeds of promising varieties have been widely distributed. An extensive planting of nursery trees made in August, 1914, in which part of the trees were set in permanent location with the roots incased in a large ball of earth from the nursery and part of the transplants were set with the earth removed from the roots, has confirmed previous results relative to the value of transplanting trees with a ball of earth attached. In the first six months the trees transplanted with the roots incased in earth showed more than three times as great an increase

in growth and for the whole year more than double the growth than that made by trees with the roots bare of earth. A year from transplanting nearly 34 per cent of the former and less than 2 per cent of the latter were producing coffee.

Fertilizer experiments with coffee were continued. As heretofore, large increases in yield have been obtained as a result of fertilizing. In a pot experiment nitrogen has been clearly shown to be the element which is most needed for the production of a satisfactory new growth. These experiments show that a need for nitrogen may be indicated by a yellowish-green leaf color. In addition to producing a darker green and more vigorous new growth, nitrogen has had the effect of increasing the number of leaves per plant. Some new experiments were started to determine the value of nitrogen from different sources and also the effect of lime on coffee planted in red clay soil. A further planting of seedlings from a coffee tree which bore both variegated foliage and green leaves indicates that the variegation can be transmitted, although the green foliage is dominant in the offspring.

In the work with cacao the individual yields of more than 300 trees are being recorded. Records have now been kept a sufficient time to show the prolific tendencies of certain individuals. The maximum yield recorded from a single tree at a single picking has been 54 pods. Pickings are made every four to six weeks. For the calendar year 1914 about one-fourth of the trees which were set 11 years before produced no crop. The others averaged 17.5 pods, or a gross return of about 22 cts. per tree. One hundred seedlings from one of the most vigorous and prolific trees have been planted in order to study the differences to be found in seedlings derived from the same tree. Studies are also being made to determine whether there is any correlation between light and dark cotyledons and light and dark beans, the color of the bean being commonly supposed to indicate the quality of the bean,

In the work with vanilla attempts to raise hybrid vanillas from seed have been unsuccessful thus far. Experiments with different lengths of vanilla cuttings for propagating have shown unquestionably that with cuttings up to those of 12 internodes every advantage lies with the longest cuttings. In view of a common opinion that vanilla is a lime lover, applications of lime were applied to four vanilla beds at the rate of 1, 2, 4, and 8 tons per acre. The results indicate that whereas a light liming may be somewhat beneficial heavy liming tends to retard growth.

Freezing-point lowering of the leaf sap of the horticultural types of Persea americana, J. A. Harris and W. Popenoe (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 6, pp. 261–268*).—The results are given of a study of the freezing-point lowering in the cell sap of the Mexican, Guatemalan, and West Indian types of avocados, the plant material being secured from trees growing at the Miami Plant Introduction Field Station.

All of the types showed considerable variation in freezing-point lowering. The range in the freezing point of the sap for the whole series was from 29.43 to 30.27° F. Within the type the absolute variation in freezing-point lowering is very slight, amounting to 0.1° C. or less. The average freezing-point lowering in the Guatemalan and Mexican types was practically the same. The West Indian type is characterized by tissue fluids which freeze at a distinctly higher temperature than in the two other groups of varieties, and is the one which has been shown by horticultural experience to be the least capable of enduring cold. The authors conclude, however, that capacity to withstand low temperatures is not solely due to differences in the freezing point of the sap, this being evident from the slightness of the differences in the cryoscopic

contents of the West Indian as compared with the Mexican and Guatemalan types. Furthermore, the plants of the Guatemalan type are generally considered to be intermediate in hardiness between those of the Mexican and West Indian types, whereas no discernible difference in the freezing point of the sap of the Mexican and Guatemalan types was observed.

The two groups of varieties of the Hicora pecan and their relation to self-sterility, H. P. Stuckey (*Georgia Sta. Bul. 124* (*1916*), *pp. 127–148, figs. 10*).—Observations made during a number of years relative to the partial or complete self-sterility of various pecan trees led the author to conclude that there are two distinct groups of varieties of the Hicora pecan. The distinguishing characteristics of these groups are described in general, and the differences and some of the characteristics of the two groups as represented by some of the varieties grown on the station grounds in 1915 and 1916 are presented in tabular form. A bibliography of references dealing with sterility in fruits is included.

Varieties of one group of pecans here observed shed their pollen at about the same time the majority of the pistillate flowers become receptive, whereas the varieties of the other group shed their first pollen after most of the pistillate flowers pass through the receptive stage. Varieties of both groups produce viable pollen, but varieties of the first group are apt to be self-fertile while those of the second group are apt to be self-sterile. Self-sterility of a variety may be expected in proportion to the interval between the receptive stage of the pistillate flowers and the shedding of the pollen. Mechanical injury to catkins before the date of normal pollen shedding may partially prevent self-sterility among varieties of the second group. Parthenogenesis in pecans is also indicated. Phenological data from varieties grown in south Georgia agree fairly closely, as regards the two groups, with that from the varieties at the station. Native hickory trees in the vicinity of the station can be divided into early and late staminate flowering groups, and it appears possible that the hickory will serve as a pollenizer for the pecan.

The effect of cultural and climatic conditions on the yield and quality of peppermint oil, F. Rabak (*U. S. Dept. Agr. Bul. 454* (*1916*), *pp. 16*).—In order to obtain data bearing on possible variations in the composition of peppermint oil under varying conditions, plants were grown under various conditions of soil and climate and were harvested at various stages of growth. The oil was distilled from certain parts and also from the entire herb in both the fresh and dry condition and was then subjected to thorough examination. The results are here presented in tabular form and discussed.

Conditions of soil and climate proved to be influential factors in the formation of peppermint oil and its constituents in the plant. Light sandy or loamy soils appear to be most favorable for the production of an oil of high quality. The yield of oil distilled from fresh plants apparently decreases as the plant matures. Drying the plant before distillation results in a considerable loss of oil. The largest proportion of oil is found in the leaves and flowering tops. On the other hand, the formation of esters and menthol in the oils increases as the plants approach maturity and with drying the plants. The formation of esters and menthol takes place most readily in the leaves and tops.

The effect of shade upon the peppermint plant is to decrease esterification and the formation of menthol, whereas the action of frost noticeably increases esterification and the formation of menthol. The decrease in the case of shade-grown plants is possibly due to the lessened activity of the elimination of water by the plant.

FORESTRY.

The economic woods of Hawaii, V. MacCaughey (*Forestry Quart., 14 (1916), No. 4, pp. 696–716*).—In this paper the author outlines the chief ecologic zones of Hawaii and gives a descriptive account of the more important economic trees with reference to their distribution and character of tree and wood.

The uses of Formosan trees, R. Kanehira (*Indian Forester, 42 (1916), No. 8, pp. 410–420*).—The author here presents a classified list of Formosan trees based upon their uses.

Investigations on the assortment ratios of spruce, silver fir, and beech, P. Flury (*Mitt. Schweiz. Centralanst. Forstl. Versuchsw., 11 (1916), No. 2, pp. 153–272, figs. 3*).—This comprises a series of timber estimating tables for individual trees and for entire stands of spruce, silver fir, and beech. Tables are also given showing the percentage distribution of wood-volume in pure even-aged and normal-stocked stands at the ages of 20, 40, 60, 80, 100, and 120 years, respectively. Introductory considerations deal with principles and systems for estimating timber and explain the application of the tables.

Influence of the intensity of thinnings on the yield of young regular stands of fir, E. Mer (*Rev. Eaux et Forêts, 54 (1916), Nos. 7, pp. 185–191; 11, pp. 305–309*).—The author gives the results of thinning experiments in some selected fir stands, the actual thinning operations having been started in 1899. The results in general confirm those secured in thinning experiments with young spruce stands (E. S. R., 35, p. 241), indicating that both early and relatively heavy thinnings act advantageously on future yield.

Douglas fir fiber, with special reference to length, H. N. Lee and E. M. Smith (*Forestry Quart., 14 (1916), No. 4, pp. 671–695, pl. 1, figs. 11*).—This study, which was conducted under the direction of the Forest Products Laboratories of Canada, deals in most part with length values of Douglas fir fibers as observed in different parts of the same tree and also in different trees. A bibliography of cited literature dealing with fiber measurement studies is included.

Some characteristics of slash pine, W. R. Mattoon (*Forestry Quart., 14 (1916), No. 4, pp. 578–588, pls. 2, figs. 2*).—A brief discussion of some characteristics of slash pine, with special reference to its rapid spread in second-growth forests, silvicultural qualities, wood structure, and commercial value of young stands.

Seeding of Hevea at different altitudes on Gunong Angsi, F. G. Spring (*Agr. Bul. Fed. Malay States, 5 (1916), No. 1, p. 3*).—In continuation of previous observations showing that the growth of the tree and yield of rubber are poor at a comparatively high altitude (E. S. R., 30, p. 535), the author here presents data showing that seed production is similarly affected. At about 1,000 ft. the yield of seed commenced to fall off, at 1,800 ft. only a few seeds were produced, while at 2,400 ft. there was no evidence of fruiting.

Ecology of sal (Shorea robusta).—II, Seedling reproduction in natural forests and its improvement, R. S. Hole and Puran Singh (*Indian Forest Rec., 5 (1916), No. 4, pp. II+43–85, pls. 9*).—This is the second contribution on the study of the causes of the dying back of sal seedlings (E. S. R., 32, p. 144). The present paper gives the results of experiments conducted during the period 1912 to 1915 in which sal seedlings were grown in different localities in the shady forests and in the open, respectively. The development of the seedlings was watched throughout the year, and as far as possible the chief factors operative at the season when death or bad growth was noticed were determined.

The forests and streams, A. A. DA SILVEIRA (*As Florestas e as Chuvas. Bello Horizonte, Minas Geraes: Govt., 1916, pp. 54, pls. 33*).—In the present paper the author presents considerable data relative to a number of streams in Brazil to show that there has been a decline in stream flow, but that there is no definite evidence to show that forests have any relation to regulation of stream flow. At the same time attention is called to the importance of planting and extending forests for the production of lumber and other forest products.

The effect of forests upon water circulation, H. A. J. M. BEEKMAN (*Invloed van Bosschen op den Waterkringloop. Surabaya, Java: Nederland.-Ind. Landb. Synd., 1916, pp. 13*).—A paper presented at the Dutch India Soil Congress, Djokja, October, 1916. It briefly summarizes the results of investigations relative to the effect of forests on rainfall and water conservation and introduces similar questions for discussion with reference to East Indian conditions.

National Forest organization, S. W. WYNNE (*Forestry Quart., 14 (1916), No. 4, pp. 589–594*).—In this article the author reviews various propositions made by Woolsey with reference to National Forest organization (E. S. R., 35, p. 451), and calls attention to a number of factors that must be taken into consideration in the development of a management system for the National Forests.

Conversion methods.—A visit to the forests of Chaux and Faye de la Montrond, France, H. R. MACMILLAN (*Forestry Quart., 14 (1916), No. 4, pp. 599–604*).—A brief survey of the forest management systems in the forests of Chaux and Faye de la Montrond.

Yearbook of the department of forestry, (*Ezheg. Lîes. Dept., 1 (1913), pp. 125+174, pls. 19, figs. 27; 2 (1913), pp. 353*).—Volume 1 comprises a report on the administration of the Russian forests in 1913, including projects for a new forestry law, the organization of new forest districts, an account of the activity of the permanent forest-culture commission, exploitation of forests, sand-binding work, yields in forest products, revenues, expenditures, etc. Volume 2 gives in tabular form the area of government forest circles in the various Provinces of Russia, with revenues and expenditures therein.

Annual progress report on forest administration in the Presidency of Bengal for the year 1914–15, C. E. MURIEL (*Rpt. Forest Admin. Bengal, 1914–15, pp. II+47+4*).—This is the usual annual report on the constitution, management, and exploitation of the state forests of Bengal, including a financial statement for the year 1914–15. All important data relative to alterations in forest areas, forest surveys, working plans, forest protection, revenues, expenditures, etc., are appended in tabular form.

Forestry in India from a Canadian point of view, H. R. MACMILLAN (*Forestry Quart., 14 (1916), No. 4, pp. 624–649*).—A survey of forestry and forest conditions in India. Consideration is given to forest distribution and ownership, organization, personnel, research, administraton, working plans, silvicultural operations, and financial aspects.

Passing views of forestry in British South Africa, H. R. MACMILLAN (*Forestry Quart., 14 (1916), No. 4, pp. 605–623*).—A general account of the progress and present situation of forestry in South Africa. Information is given relative to the physiography and climate of the different regions of South Africa, forest distribution and composition, development of forestry, present organization, working plans and market, and silvicultural management.

Report of the director of forests, N. W. JOLLY (*Ann. Rpt. Dir. Forests [Queensland], 1915, pp. 8, pls. 3*).—A report relative to the administration and management of the state forests of Queensland, including a financial statement for the year. Tabular data on the sawmilling industry, timber reserves, state forests and national parks, and collections under the timber and quarry regulations from 1908 to 1915 are also included.

China's forest laws, W. F. Sherfesee (*Forestry Quart.*, *14* (*1916*), *No. 4*, *pp. 650–661*).—This comprises a free translation of the forest laws or mandates issued since the inauguration of the Chinese republic, together with the translation of certain documents dealing with the organization of the present Chinese national forest service.

DISEASES OF PLANTS.

[Serious plant diseases in 1914], D. Reddick (*West. N. Y. Hort. Soc. Proc.*, *60* (*1915*), *pp. 78–81*).—The author states that *Venturia inæqualis*, the cause of apple scab, was destructive throughout the State of New York, the damage done being at least as great as in 1910. Fire blight, due to *Bacillus amylovorus*, was preeminently an apple disease during 1914. No suitable method of controlling the fire blight in old trees has been found, but for young trees, careful pruning and use of corrosive sublimate (1:1000) are the remedies recommended.

Peach leaf curl, due to *Exoascus deformans*, was generally prevalent throughout the State. The many cases noted of successful control are thought to indicate that failures are due to bad method or wrong time of spraying. Peach mildew, due to *Podosphæra oxyacanthæ*, was not reported in 1914, owing, presumably, to the absence of fruit.

The raspberry bushes did not show injury from cold until relatively late in the season. Anthracnose (*Glœosporium venetum*) was further studied.

Downy mildew (*Plasmopara viticola*) became destructive in the Keuka Lake region. This is easily controlled with Bordeaux mixture. Powdery mildew (*Uncinula necator*) was abundant in the Chautauqua grape belt. The use of Bordeaux mixture about August 1 is recommended. Dead-arm disease has already been reported (E. S. R., 32, p. 52).

Report of the plant pathologist, E. W. Brandes (*Porto Rico Sta. Rpt. 1915*, *pp. 34*, *35*).—A brief account is given of some experiments for the control of the banana disease described on page 352. In addition, the author has investigated the practicability of controlling diseases of coffee, vanilla, and mangosteen.

[Report on plant pathology], C. H. Knowles (*Fiji Dept. Agr. Ann. Rpt. 1915*, *pp. 26–31*).—This is the report for the division of plant pathology on diseases of economic plants, some ornamentals, and several weeds.

Coconut is attacked by a disease very similar to that caused by *Pestalozzia palmarum*, but this fungus has larger spores. The same leaflets (usually old or unhealthy ones) are sometimes attacked by a fungus identified as *Graphiola cocoina*. The remedy, as also in case of Pestalozzia, is restoration of vigor in trees. Coffee at the Nasinu station showed a leaf disease due to *Hemileia vastatrix*.

Cacao brown rot, due to *Thyridaria tarda*, was found at Lami. This fungus also causes a dieback of the younger branches. Pink disease (*Corticium lilacofuscum*) was noted in one locality. Its chief objectionable feature is the splitting of the bark, allowing other fungi to enter. Black rot, attacking mostly young pods, may prove to be due to *Phytophthora faberi*. A brown root disease destroying cacao plants may be the same as that (*Hymenochæte noxia*) causing a similar disease in para rubber, which also shows leaf diseases probably due to *Pestalozzia palmarum* and *P. guepini*.

A spot disease of banana leaves showed spores of *Cercospora musæ* and other fungi. A nematode, probably *Tylenchus similis*, also causes damage to banana by attacking the roots.

Tobacco showing leaf spots proved to be affected by *Cercospora raciborskii*. Yams are attacked by a leaf disease caused by *Glœosporium pestis*. A leaf spot of sisal plants was found to contain *Macrosporium lanceolatum*. Leaves of cloves bearing reddish or purplish marks, at the Nasinu station, showed a Peronospora. Jute showing a leaf spot yielded a Cercospora. A tomato wilt could not be traced to any definite cause.

Kentia macarthurii showing a leaf spot yielded a Pestalozzia. A comparison is made of the spores of the forms of this fungus found on Hevea and Kentia leaves and on ripe fruit of Garcinia. A disease of Livistonia was associated with *Graphiola phœnicis*. *Licuala grandis* showed brown intervenous areas associated with a Colletotrichum. Rose leaves were attacked by *Actinonema rosæ*. *Cassia fistula* was apparently attacked by a fungus which was not classified.

Several weeds are named as being attacked by fungi.

Report of the imperial mycologist, F. J. F. SHAW (*Ann. Rpts. Expert Offs. Dept. Agr., Bengal, 1915, pp. 144, 145*).—It is said that experiments looking to the control of ufra disease have been only partly successful. A disease of betel vine occurring near Bogra was found to be caused by *Rhizoctonia destruens*, particulars regarding which are to be given in a memoir now in press. Anthracnose of betel is said to be a different disease, the causation of which is obscure. Potato blight was studied and the results are to appear later. A disease of areca palm may be due to a form of *Fomes lucidus*.

Report on the first two years' working of the plant protection law (Law No. 5 of 1913), G. STOREY (*Min. Agr. Egypt, Tech. and Sci. Serv. Bul. 1 (1916), pp. 37*).—This contains an account of the legislation for plant protection in force prior and subsequent to the formation of the Department of Agriculture of Egypt in 1911, and of the action as taken in cases arising thereunder; also an appendix giving the new law of 1916, which supersedes the law of 1913.

Besides giving an account of insect pests found in or on plants offered for importation, mention is made of infestation by such parasites as *Cladosporium citri* on oranges from Syria, *Venturia pomi* on apples, *Sclerotinia fructigena* causing a brown fruit rot on peaches from Italy, and *Tylenchus tritici*, which, however, is already present in Egypt on wheat.

Studies on a Fusarium disease of corn and sorghum, L. H. PAMMEL, CHARLOTTE M. KING, and J. L. SEAL (*Iowa Sta. Research Bul. 33 (1916), pp. 115–136, figs. 15*).—A preliminary report is given of a study of a Fusarium disease of corn which is said to have made its appearance in Iowa during 1914 and which was again abundant in 1915, causing a large estimated loss. The fungus attacks the roots, stalks, and ears of the corn. The effects on the different parts of the plant are described, and the results of a study of the organism are given.

The fungus causing the disease is definitely referred to a species of Fusarium, and in connection with the trouble the perithecia of Gibberella has been found, but the authors have not been able to show that this fungus has any relation to the Fusarium. The disease is believed to be spread largely through the seed corn, and careful selection of seed is recommended as a preventive measure.

A Fusarium disease of sorghum, which is similar to, if not identical with, that on corn, is also described.

Clover sickness, A. AMOS (*Jour. Farmers' Club [London], 1916, May, pp. 61–76*).—This is an account, with discussions, of observations on clover sickness, which is ascribed to the presence of *Sclerotinia trifoliorum* or of *Tylenchus devastatrix*, or of both. Several remedies are discussed, but it is thought that clover may be protected from both of these enemies by the same general prac-

tice, namely, that of alternating the red clover crop with sainfoin or trefoil, either alone or mixed with Italian rye grass.

[Ufra disease], G. P. HECTOR (*Ann. Rpts. Expert Offs. Dept. Agr., Bengal, 1915, p. 143*).—Experiments at various points on the control of ufra disease of rice are described. In one set of these, burning the stubble and turning the soil several times controlled the disease completely, while in another set one plat was slightly attacked after this treatment. It is considered improbable that any variety of rice is immune, but some varieties seem to escape owing to their ripening so early as to avoid violent attack.

Resistance in tobacco to the root rot disease, J. JOHNSON (*Phytopathology, 6 (1916), No. 2, pp. 167–181, figs. 6*).—The results of two years' experiments on the relative resistance of selected strains of tobacco to the root rot caused by *Thielavia basicola* are given. The experiments were carried on mainly in Ontario and Wisconsin, the work in Canada being largely with the Burley type of tobacco while that in Wisconsin was confined to cigar leaf selection.

The author states that a strain of White Burley has been developed which possesses a high degree of resistance. Strains of cigar leaf tobacco are known to exist that are practically immune to root rot, but the quality of these types is considered unsatisfactory. Selection breeding is thought to offer the most promising field for investigation for control of this root rot disease.

Host plants of Thielavia basicola, J. JOHNSON (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 6, pp. 289–300, pls. 2*).—The results are given of an investigation of the host plants of this fungus, carried on at the Wisconsin Experiment Station in cooperation with this Department.

About 200 species of plants were grown on soil known to be infected with *T. basicola*, and under favorable conditions for the development of the fungus the following families of plants were found to be attacked: Araliaceæ, Bignoniaceæ, Compositæ, Convolvulaceæ, Crucifereæ, Cucurbitaceæ, Hydrophyllaceæ, Leguminosæ, Malvaceæ, Orchidaceæ, Oxalidaceæ, Papaveraceæ, Polemoniaceæ, Portulaceæ, Primulaceæ, Scrophulariaceæ, Solanaceæ, and Violaceæ. Among the plants studied, the author added 66 species to the list of known hosts of *T. basicola*, 28 of these being legumes, 20 solanaceous plants, 7 cucurbits, and 11 belonging to miscellaneous families.

It is considered that a difference in the susceptibility of the various species exists, and where earlier investigators have been inclined to doubt the parasitism of the organism, it is believed that their infection experiments were carried on with what are known to be immune or very resistant plants. Basing his conclusion on evidence from nearly 100 species of plants infected with *T. basicola* from tobacco, the author considers that there are no specialized races of this fungus.

Diseases of vegetables, I. C. JAGGER (*West. N. Y. Hort. Soc. Proc., 60 (1915), pp. 140–147*).—This is a discussion of experiences, chiefly with bacterial blight, early blight, and late blight of celery; club root of crucifers, due to slime mold; root knot of cucumbers, tomatoes, lettuce, and other greenhouse plants, due to nematodes; and onion smut.

Cucumber mosaic disease, W. W. GILBERT (*Phytopathology, 6 (1916), No. 2, pp. 143, 144, pl. 1*).—A brief outline is given of work in progress in investigating the mosaic disease of cucumbers, which is known to occur both in greenhouses and in fields.

A new infectious mosaic disease of cucumber, S. P. DOOLITTLE (*Phytopathology, 6 (1916), No. 2, pp. 145–147*).—The author gives a description of field observations and laboratory and field experiments on the cucumber mosaic disease.

No constantly associated organism has been found, but the rapid spread of the disease through fields is considered to indicate that it is highly infectious. As a result of field experiments, the disease was succesfully produced through inoculation experiments in which the broken ends of diseased petioles were touched to wounds on cucumber vines, the injection of expressed and filtered juice, insertion of fragments of diseased tissue, etc. Experiments carried on in Michigan indicate that insects, particularly the melon aphis (*Aphis gossypii*), play an important part in the transmission of this disease. Successful inoculations have also been made on pumpkins and muskmelons. In laboratory experiments, a type of infection characterized by the entire wilting of the plant appeared, but it has not been observed in the field.

Experiments with the cucumber mosaic disease, I. C. Jagger (*Phytopathology, 6 (1916), No. 2, pp. 148–151*).—The results of experiments carried out in a greenhouse in the vicinity of Rochester, N. Y., are described.

Successful inoculation was secured when the expressed juices of leaves, stems, and fruits, either filtered or not, were injected into sound cucumber plants. Similar results were obtained by crushing diseased leaves in the hand and then rubbing sound ones, or by growing sound and diseased plants so that the foliage intermingled. Cucumber plants in contact only through their roots did not develop the disease.

In addition to the cucumber, the author reports successful inoculations on the summer squash, pumpkin, and two varieties of gourd.

Rotting of greenhouse lettuce, I. C. Jagger (*West. N. Y. Hort. Soc. Proc., 60 (1915), pp. 147, 148*).—A discussion of the rots of lettuce ascribed respectively to Botrytis, Rhizoctonia, and Sclerotinia concludes with the statement that the first two can be largely prevented by securing a vigorous growth, keeping the plants and soil surface free from superfluous moisture, and maintaining moderate temperature and humidity. Rhizoctonia and Sclerotinia can be temporarily controlled by sterilization with steam in the autumn.

Tomato blight, F. D. Heald (*Rpt. Wash. Hort. Assoc., 12 (1915), pp. 35–42, fig. 1*).—Investigation during 1915 is stated to have shown that the tomato blight, ascribed by Humphrey (E. S. R., 32, p. 444) to one or more species of Fusarium, is really caused by a Rhizoctonia. The name Rhizoctonia disease is selected as most appropriate. The fungus is said to be almost omnivorous. Clean soil, abundant moisture, liberal fertilizer, correction of acidity with lime, deep setting of plantlets, and early fall plowing of suspected soils are recommended as protective measures.

A troublesome disease on winter tomatoes, J. E. Howitt and R. E. Stone (*Phytopathology, 6 (1916), No. 2, pp. 162–166*).—It is stated that in the spring of 1914 tomatoes in forcing houses near Hamilton, Ontario, showed a markedly diseased condition of the leaves, stems, and fruit. Later in the year the trouble reappeared, causing almost complete failure of the crop. This disease, the symptoms of which are described, seems to be rather widely distributed. Repeated microscopic examinations, culture tests, and inoculation experiments have failed to disclose a causal organism.

From the position and nature of the lesions and the fact that the disease fails to develop in affected fruits when they are removed from the plant, the authors have been led to conclude that the disease is a physiological trouble. Experiments with sterilized soil are believed to indicate that the disease is in some way connected with soil conditions.

Powdery mildew demonstrations on the apple, grape, and peach during the season 1915, L. Powell (*Rpt. Wash. State Hort. Assoc., 12 (1915), pp. 42–46*).—It is stated that in tests made in Benton County, Wash., following out the instructions given by Ballard and Volck (E. S. R., 31, p. 748), satisfactory results

were obtained with the three liquid sprays iron sulphid, atomic sulphur, and milled sulphur on grapevines and peach trees. The experiments with apple trees, though apparently beneficial, are considered to require confirmation by further tests.

Comparative dusting and spraying experiments, D. Reddick and C. R. Crosby (*West. N. Y. Hort. Soc. Proc., 60 (1915), pp. 68–77*).—These tests related mainly to insect control, the only disease amenable to the treatments given being apple scab. This trouble was pronounced in some localities in 1913 and very general in 1914.

It is said that the time of application is most important. The dust method is deemed applicable in case of large, old trees, where it is most needed, is from three to six times as rapid as that of spraying, and the total cost for dusting per tree is not greater than for spraying. The mixture, of which 2 to 3 lbs. should be applied to each tree at each time, is 90 per cent sulphur and 10 per cent lead arsenate, the latter being intended for insects.

No reports of injury from breathing the dust have been received. The sprayer is recommended in case of apple varieties which are very susceptible to scab.

See also the bulletin already noted (E. S. R., 34, p. 738).

Note on apple root rot in Virginia, C. H. Crabill (*Phytopathology, 6 (1916), No. 2, pp. 159–161, fig. 1*).—The author states that the root rot previously described (E. S. R., 33, p. 544) is quite prevalent in the Shenandoah Valley and Piedmont section of Virginia. It is more prevalent on new ground, especially where the soil contains decaying wood, and is present in a wide variety of soils and in many localities. In many orchards, several adjoining trees appear to have contracted the disease at about the same time. Some varieties of apples are said to be very susceptible, while others are less liable to attack.

The roots of the infected trees were found to be infested with a delicate white mycelium, and the fungus has been identified as *Trichoderma koeningi*. While the organism is generally considered a wound parasite, the author believes that there is some evidence that it occurs on apple roots as a parasite.

Apple rosette, O. M. Morris (*Rpt. Wash. State Hort. Assoc., 12 (1915), pp. 69–72*).—Reporting briefly the results of a survey by correspondence extending over several States, the author holds that apple rosette is somehow connected with the nutrition of the plant. While treatment in some sections should look to improving the humus content of the soil, different means must be employed in other sections, such as drainage and improvement of physical condition.

Sulphur paste as a spray for peaches, D. Reddick (*Phytopathology, 6 (1916), No. 2, pp. 206, 207*).—Attention is called to the ease of preparation and excellent suspension of sulphur paste, which is said to be quite efficient for the control of brown rot and scab of peaches. Directions for the preparation of the paste are given.

Pear blight (Bacillus amylovorus), T. O. Morrison (*Rpt. Wash. State Hort. Assoc., 12 (1915), pp. 131–133*).—This is part of a report by the author on horticultural field conditions in 1915, and deals with the progress at various points during the year of *B. amylovorus*, the cause of fire blight. This is thought to have reached its highest mark during 1914 and to be now somewhat on the decline, which may possibly be accelerated by uniform control measures throughout the orchard districts.

Further studies in the rôle of insects in the dissemination of fire blight bacteria, V. B. Stewart and M. D. Leonard (*Phytopathology, 6 (1916), No. 2, pp. 152–158*).—During the summer of 1915 the authors carried on experiments with *Pollenia rudis*, *Empoasca mali*, *Psylla pyricola*, *Plagiognathus politus*, and

Sapromyza bispina to determine the possibility of these insects serving as carriers of *Bacillus amylovorus.*

From previous experiments (E. S. R., 33, p. 744), together with the data given in the present paper, the authors conclude that practically all insects which might be important in producing fire blight infections in nurseries have been considered. The various species of flies were not found active agents in increasing the number of fire blight infections, although when blight is very prevalent and flies numerous, a few infections may be produced by these insects. Most of the infection seems to be transmitted through biting or sucking bugs.

Following the observations of Heald (E. S. R., 34, p. 647), the authors investigated the possibility of infection through the water pores of the leaves. From their investigations there is considered to be little, if any, infection through the water pores, injury to the tissue being necessary before the bacteria can produce infection.

Preliminary studies on the resistance of Prunus to artificial inoculation with Bacterium tumefaciens, C. O. Smith (*Phytopathology, 6 (1916), No. 2, pp. 186–194, pl. 1*).—In order to determine more resistant stock on which to graft almonds, peaches, etc., the author has conducted inoculation experiments with about 30 species and varieties of the genus Prunus.

All the hosts developed typical galls from artificial inoculations except *P. pumila*, *P. ilicifolia*, and *P. caroliniana*. No varieties of almonds or peaches have been found to show marked resistance, but among the plums it is thought that *P. americana* and *P. hortulana* would be well adapted to native species of plums which are not much grown in California. The most popular strains used for grafting were all found very susceptible to crown gall. So far as the investigation has progressed, the author states, no definite recommendation can be made as to the use of resistant stock, although the seedlings of certain German and Italian prunes should be well adapted as a stock for members of the Domestica group.

A Porto Rican disease of bananas, G. L. Fawcett (*Porto Rico Sta. Rpt. 1915, pp. 36–41, pl. 1*).—A preliminary account is given of a disease of the variety of banana known as Chamaluco. The disease is said to be quite destructive on this variety, and from diseased tissues a species of Fusarium has been isolated which corresponds closely with that described by Ashby (E. S. R., 29, p. 350). Other organisms were found in the tissues, and the author, from his preliminary investigation, is led to believe that the Fusarium is only in part the cause of the trouble.

For its control, rotation of crops is recommended, and under present conditions, the variety Chamaluco can be considered only a temporary crop.

Citrus canker investigations, W. Newell (*Quart. Bul. Plant Bd. Fla., 1 (1916), No. 1, pp. 1, 2*).—A brief outline is given of the work undertaken by the Florida Plant Board for the eradication of citrus canker in that State.

Means of identifying citrus canker, R. A. Jehle (*Quart. Bul. Plant Bd. Fla., 1 (1916), No. 1, pp. 2–10, pls. 9*).—The author gives a list of citrus plants which are subject to citrus canker attack, enumerating them in the order of susceptibility to the disease, after which the characteristics of the disease on the leaves, stems, and fruits of the different hosts are described.

Sour scab of citrus in Florida, and its prevention, J. G. Grossenbacher (*Phytopathology, 6 (1916), No. 2, pp. 127–142, figs. 4*).—The author describes under the name of sour scab a disease of leaves, twigs, and fruits of certain varieties of citrus which have a strongly acid sap in their growing portions.

This name is preferred to the name lemon scab, which was originally given the disease when it was considered to attack lemons chiefly. The disease is known to occur on the sour orange, lemon, citron, certain varieties of grapefruit, etc. Sour scab is said to cause considerable financial loss in the growing of grapefruit in Florida, Cuba, and the Isle of Pines.

The disease develops most destructively in seasons and localities which have abundant moisture in the air and soil during the development of the early spring growth. Trees starting later in growth appear less subject to the disease, and it is thought that possibly selection from such individual trees might prove of value in reducing loss from this trouble.

The cause of the disease is claimed not to have been definitely determined, but among the agents frequently considered to produce the trouble is *Cladosporium citri*. The author's investigations, it is claimed, indicate that this fungus is only partially responsible for producing the disease. The long-continued presence of water on rapidly growing leaves and shoots and on young grapefruits, together with excessive hydrostatic pressures during growth, is believed to have a causal relation to sour scab.

From the reports of experiments covering three years, the author believes that spraying with Bordeaux mixture or lime sulphur solution would protect the fruit. Pruning as a method of restricting the spread has proved impracticable and in some cases even injurious.

Diseases of forest and shade trees, D. C. Babcock (*Mo. Bul. Ohio Sta., 1 (1916), Nos. 10, pp. 291–296, fig. 1; 11, pp. 333–339, figs. 4*).—Popular descriptions are given of a number of the more common diseases of forest and shade trees in Ohio, and where definite means are known, suggestions are given for their control.

An outbreak of white pine blister rust in Ontario, J. E. Howitt and W. A. McCubbin (*Phytopathology, 6 (1916), No. 2, pp. 182–185*).—The Cronartium stage of the white pine blister rust is said to have been found on five cultivated and four wild species of Ribes in nine counties in the Province of Ontario, and the Peridermium stage has been found on both imported and native white pines. Black currant plantations have in many instances been severely injured. An examination of imported white pines has indicated that they are the source of infection in the majority of cases. According to the authors' observations, the rust may be passed from currant to currant over an intervening distance of at least 800 yds. Spraying experiments indicate that the rust on currants may be markedly reduced by the application of Bordeaux mixture or soluble sulphur. There is thought to be some evidence that the rust may possibly winter on the currant.

Methods of preparation and relative value of Bordeaux mixtures, O. Butler (*New Hampshire Sta. Sci. Contrib. 9 (1915), pp. 2–12; Off. Rpt. Sess. Internat. Cong. Vit., 1915, pp. 151–160*).—The characters that a copper fungicide must possess are noted, and the three types to which, as previously stated (E. S. R., 31, p. 802), Bordeaux mixtures may be reduced are enumerated, and tabular data reported regarding various phases, properties, and effects of this fungicide.

The author states that acid and neutral Bordeaux mixtures are less injurious to the grape than are the alkaline preparations, although the toxic value of the unit copper is the same in each of these phases of the fungicide. When immediate action is required, the unit copper in acid and in neutral Bordeaux mixture is said to be more effective than is that in alkaline preparations, the last named, however, being more adhesive than the other two.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The larger North American mammals, E. W. Nelson (*Nat. Geogr. Mag., 30 (1916), No. 5, pp. 385–472, pl. 1, figs. 73*).—This paper includes accounts of 57 large North American mammals and colored illustrations from paintings by Louis Agassiz Fuertes of each of the animals considered.

Interim report on the feeding habits of the rook (Corvus frugilegus), H. S. Leigh (*London: Econ. Ornithol. Committee, Brit. Assoc. Adv. Sci., 1914, pp. 15*).—"The results of this investigation, so far as it has progressed from the consideration of 209 stomachs, show that a large proportion of the food of the rook consists of grain, and that it is taken mainly in the autumn, winter, and early spring months. The total amount of animal food is not so large as grain, but reaches a high percentage during May, June, July, August, and September. There is some evidence to show that a grain diet may be preferred, but there is also evidence which shows that a great many insects (about half of which are injurious) are taken by the rook particularly in its nestling stage, and that it is therefore most important to have a good supply of birds during this phase in its life history. It is difficult from the evidence yet obtained by this inquiry to say whether the rook is on the whole a beneficial or an injurious bird, as the material upon which the account is based is not sufficiently representative."

The rat and infantile paralysis: A theory, M. W. Richardson (*Boston Med. and Surg. Jour., 175 (1916), No. 12, pp. 397–400; abs. in Jour Amer. Med. Assoc., 67 (1916), No. 15, p. 1113*).—The author presents facts and reports observations which support the theory that poliomyelitis is transferred by rodents or by insects, or by both. In the transfer of the infection from rat to man the agency of the flea is assumed, although possible contamination of food by rodent excretions is suggested.

The animal parasites of man, the diseases which they transmit, and their treatment, M. Braun and O. Seifert (*Die tierischen Parasiten des Menschen, die von ihnen Hervorgerufenen Erkrankungen und ihre Heilung. Wurzburg: Curt Kabitzsch, 1915, vol. 1, 5. rev. and enl. ed., pp. X+559, figs. 407*).—This first volume deals with the natural history of the animal parasites of man, including classified bibliography (pp. 451–545). See also the work of Fantham et al. (E. S. R., 36, p. 152).

A new and economically important tapeworm, Multiceps gaigeri, from the dog, M. C. Hall (*Jour. Amer. Vet. Med. Assoc., 50 (1916), No. 2, pp. 214–223, figs. 4*).—*M. gaigeri*, of which the dog is the primary and *Capra hircus* the secondary host in India, is described as new.

Report of the entomologist, R. H. Van Zwaluwenburg (*Porto Rico Sta. Rpt. 1915, pp. 42–45*).—In the search for a shade tree for coffee in which the hormiguilla (*Myrmelachista ambigua ramulorum*) can not colonize with guest scales, 12 common native tree species were experimented with, but no tree suitable for shade was found in which the ants could not be forced to colonize. Colonies of this ant seem to thrive better and cause more damage when the pink scale (*Coccus* sp.) is the guest than when the mealy bug alone is harbored. The coffee leaf weevil (*Lachnopus* sp.), which is very destructive to coffee at the higher altitudes, has not been observed to occur at an elevation lower than 300 meters (984 ft.). In some districts it is the most serious pest of coffee. It feeds on the edges of young leaves, but the greatest loss is caused through feeding on flowers, young buds, and the newly-set berries.

A common weevil, *Baris torquatus*, was found breeding in the branches of eggplant, in some cases killing the plants completely. Since its developmental stages are passed within the stems of the plant it may be easily controlled by removing and destroying them. A lace-wing (*Corythaica monacha*), which is very common on the eggplant, causes the plants to curl and turn brown.

Eutermes morio, which causes great damage to furniture and woodwork, can be effectively controlled at a small expense by placing liberal quantities of any powdered arsenical poison in the runways and nest. A second important termite, which injures woodwork and furniture, probably *Leucotermes* sp., can be effectively controlled by fumigation with hydrocyanic acid gas.

A rhinoceros beetle (*Strategus quadrifoveatus*) in the adult stage often kills young coconut trees by entering the nut below the surface of the ground and eating its way upward, attacking the main shoot.

Several miscellaneous pests mentioned are the round-headed borer (*Apate francisca*) which bores in young mahogany trees and also does damage to coffee, citrus, and gandule or pigeon peas; a lepidopterous larva which disfigures ornamental palms; a noctuid larva (probably *Eriopus floridensis*) on the fronds of ornamental ferns; *Aspidiotus destructor* which often seriously injures coconut trees, especially in the dry region in the southwest corner of the island; a weevil found breeding in the flower buds of eggplant; the larva of *Empyreuma lichas* which attacks oleanders; etc.

[Papers on insects and insect control] (*Ann. Serv. Épiphyties, Mem. et Rap., 2 (1913), pp. 109–155, 188–232, 266–272, 285–301, 311–340, figs. 41*).—This second volume (E. S. R., 34, p. 850) includes a number of papers relating to economic entomology, namely, Investigations of the Eudemis and Cochylis Moths in Bordeaux in 1913 (pp. 109–152) and a Note on the Oblong Scale (*Lecanium persicæ*) and Treatment of Vines Infested by It (pp. 153–155), by J. Feytaud; The Microparasites of Insects and Their Utilization, by A. Paillot (pp. 188–232), which includes a classified bibliography; Observations of the Asparagus Fly and Control Measures, by P. Lesne (pp. 266–272); The Action of Hydrocyanic Acid Gas on the West Indian Peach Scale, by A. Vuillet (pp. 285–287); Note on Coccidæ Received at the Paris Entomological Station in 1913, by P. Vayssière (pp. 288–301); *Holcocneme cæruleocarpa*, a Sawfly Enemy of Cultivated Ranunculaceæ, by J. Chatanay (pp. 311–320); and *Cleonus mendicus* and *Lixus scabricollis*, Curculionids Injurious to the Beet, by F. Picard (pp. 321–340).

[Report on] economic zoology (*Ann. Rpt. Bd. Sci. Advice India, 1914–15, pp. 148–166*).—The first part of this report (pp. 148–162) by T. B. Fletcher relates to agricultural entomology, and the second part (pp. 162–166), by C. F. C. Beeson, to forest entomology.

Report of the tobacco insect investigations, G. B. Merrill (*Rpt. Bd. Comrs. Agr. P. R., 4 (1914–15), pp. 50–52*).—A brief statement of the work of the year with tobacco insects.

The fleabeetles *Epitrix fuscata* and *E. parvula* are said to be the most important insect enemies of the tobacco plant in Porto Rico. The changa or mole cricket, which is injurious in the seed beds and to newly-set transplants, comes next in importance.

Insect pests of tea in northeast India during the season 1915, E. A. Andrews (*Indian Tea Assoc., Sci. Dept. Quart. Jour., No. 1 (1916), pp. 1–6*).—This extract from the report of the general committee of the Indian Tea Association for the year ended December 31, 1915, reports briefly upon the occurrence of the more important insect enemies of tea.

Preliminary catalogue of the orthopteroid insects of the Philippine Islands, L. Bruner (*Univ. [Nebr.] Studies, 15 (1915), No. 2, pp. 195–281*).—In this list, which supplements that of 286 species in Elera's catalogue of the Philippine fauna,[1] the author gives 733 names.

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[1] Catálogo Sistemático de Toda la Fauna de Filipinas. Manila, 1895, vol. 2, pp. 189–223.

Second campaign against locusts (Stauronotus maroccanus) in Algeria by means of Coccobacillus acridiorum, M. BÉGUET (*Ann. Inst. Pasteur, 29 (1915), No. 10, pp. 520–536*).—This is a report of work carried on in continuation of that previously noted (E. S. R., 33, p. 653).

Third campaign against locusts (Schistocerca peregrina) in Algeria by means of Coccobacillus acridiorum, M. BÉGUET, L. MUSSO, and ÉTIENNE SERGENT (*Bul. Soc. Path. Exot., 8 (1915), No. 9, pp. 634–637; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 2, p. 45*).—A continuation of the work noted above.

The native food plants of the apple red bugs, R. A. CUSHMAN (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, p. 196*).—The author reports observations of the apple red bugs (*Heterocordylus malinus* and *Lygidea mendax*) at Geneva and Westfield, N. Y., and Clearfield, Pa.

"It is evident that the natural food plant of *H. malinus* is not Pyrus but Cratægus, that the reverse is true for *L. mendax*, and that *L. mendax* is more likely to attack apple than is *H. malinus*. It would seem that a reversal of the specific names would have been more indicative of the true conditions, though not entirely appropriate, since the apple is not the natural food plant of either."

Bedbugs and relapsing fever, V. K. STEPHANSKY (*Russ. Vrach, 14 (1915), No. 10; abs. in Jour. Amer. Med. Assoc., 65 (1915), No. 11, p. 987*).—The author reports that spirochetes ingested by old and young generations of bedbugs engorged upon patients with relapsing fever lost their motility within one hour and disappeared altogether after four or five hours. In experiments in which ten adult bedbugs infected with relapsing fever were killed and an emulsion made of them in normal salt solution, negative results were obtained when injected subcutaneously into monkeys. Sixty-five infected bedbugs and their young were fed once a week on the blood of a perfectly healthy man, who during the course of two months was bitten by them at least 500 times and remained unaffected.

From these results the author concludes that this insect plays no part in the spread of relapsing fever.

A contribution to the knowledge of the bloodsucking Hemiptera of Central America, A. NEIVA (*Brazil Med., 29 (1915), No. 1, pp. 1–3; abs. in Jour. Amer. Med. Assoc., 64 (1915), No. 10, p. 867*).—This is a preliminary note on the hematophagous Hemiptera of Central America.

The temperature necessary for the destruction of lice and their eggs, A. W. BACOT (*Brit. Med. Jour., No. 2874 (1916), p. 167; abs. in Rev. Appl. Ent., Ser. B, 4 (1916), No. 4, pp. 57, 58*).—The author concludes "that dry heat or submersion in water at 55° C (131° F.) kills both active lice and their eggs. It follows as a consequence that considerably lower temperatures than those usually employed may be used to destroy these vermin. For the thorough sterilization of infested garments the question of penetration is all-important. It is probable that considerable economy in fuel might be effected by allowing a longer exposure at a lower temperature, while it should be practicable to use quite lightly built chambers or temporarily adapted rooms to obtain dry air temperatures of, say, 60° C. (140° F.)."

Rosy apple aphis, A. C. BAKER and W. F. TURNER (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 7, pp. 321–344, pls. 6*).—This plant louse is said to be undoubtedly the most injurious leaf-feeding apple aphis, since its attacks not only injure the foliage and deform the growing apple trees but when abundant or unchecked it deforms the fruit, causing the production of "aphis apples" which are unfit for sale. The present paper is based upon studies conducted during the seasons of 1914 and 1915 in the vicinity of Washington, D. C.

After a careful study of European specimens and the literature, the authors have come to the conclusion that *Aphis malifoliæ* is the only name to apply to the species. The name *A. sorbi* applies to a different form, originally described from specimens on Sorbus. The authors have been unable to rear the rosy apple aphis on the host plant of the European *A. sorbi*.

Life history studies have been summarized by the authors as follows: "The eggs of this species begin hatching early in April (about April 8 in 1915) and hatching ceases in about a week (April 16 in 1915). The first stem mothers begin reproduction about April 25. From five to seven generations of the spring forms occur on apple in Virginia, although Ross reports the species all summer on apple in Ontario. The first generation is wingless. A few winged forms appear in the next generation and their percentage to the wingless insects increases steadily in each generation until finally all the insects produced become winged. Intermediates may also occur, these acquiring the wingless habits and behaving like wingless insects.

"Migration to plantain commences about May 20, and most of the insects have left the apple by about June 20. A few may continue on apple till about July 1. From 4 to 14 generations of the summer form occur at Vienna, Va. These insects are practically all wingless, only a few occasional winged insects appearing.

"The first fall migrants become adult about the second week of September (September 13 in 1915; these insects were born on August 31). They remain on the trees until after November 1. (In the writers' experiments they were produced till a much later period, but in the field they succumb to prevailing low temperatures more quickly than do either oviparous females or males.) Production of oviparous females commences about the middle to the twentieth of September, but very few are produced till early in October and their production is at its height about the middle of that month. Males begin to appear early in October, at the time the oviparous females begin to become adults, and the males also are most numerous about the last of October and early in November. Oviposition commences the middle of October and continues till the oviparous females are all dead. Some oviparous females may oviposit as late as the latter part of December in case excessive low temperatures have not occurred before that time."

A synopsis of the genus Calaphis, A. C. Baker (*Proc. Ent. Soc. Wash.*, *18* (*1916*), *No. 3*, *pp. 184–189*).—The author recognizes five species of this genus from the United States, of which two, *Calaphis castaneoides* and *C. alni*, from specimens on Castanea and on alder, respectively, at Washington, D. C., are described as new.

The development of the Phylloxera vastatrix leaf gall, H. R. Rosen (*Amer. Jour. Bot.*, *3* (*1916*), *No. 7*, *pp. 337–360*, *pls. 2*, *figs. 5*).—This paper includes a bibliography of 31 titles.

The San José scale (Aspidiotus perniciosus), L. M. Peairs and J. H. Merrill (*Kansas Sta. Bul. 214* (*1916*), *pp. 5–28*, *figs. 11*).—This is a general account of the San José scale and measures for its control, particularly such as apply to Kansas conditions. Serious infestation by this scale was first found in Kansas in 1906, though it is thought to have been present for some years previous to that date.

The control of the gray scale (Coccus citricola) in the San Joaquin Valley, R. P. Cundiff (*Proc. Fruit Growers' Conv. Cal.*, *47* (*1915*), *pp. 248–257*).—It is stated that in addition to a more or less general infestation in most of the citrus fruit-growing sections south of the Tehachapi Mountains, this scale is now very generally distributed throughout the citrus districts of the San Joaquin and Sacramento valleys. Fumigation is the only successful means of control.

Two destructive fall caterpillars, J. S. Houser (*Mo. Bul. Ohio Sta., 1 (1916), No. 10, pp. 297–303, figs. 9*).—Brief popular accounts are given of the walnut datana caterpillar (*Datana integerrima*) and the yellow-necked apple caterpillar (*D. ministra*). These two leaf-eating caterpillars having somewhat similar habits and appearance have for the past few years attacked walnut and apple trees in all parts of Ohio during the late summer and early fall.

Laspeyresia molesta, an important new insect enemy of the peach, A. L. Quaintance and W. B. Wood (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 8, pp. 373–378, pls. 6*).—In this preliminary paper the authors call attention to the discovery in the District of Columbia and environs of an important insect enemy of the peach believed to be new to this country and apparently new to science.

A technical description of it under the name *Laspeyresia molesta*, prepared by A. Busck, together with comments on its relationship and possible origin, are incorporated. The authors' observations of it during the summer and fall of 1916 indicate that another formidable insect enemy of the peach and other deciduous fruits has become established in America. The belief that it originated in Japan is strengthened by the rearing from pears received in this country from Japan of a single specimen that can not be differentiated from it. It is said to be generally present on peach trees in yards and elsewhere in the city of Washington and adjacent towns in Virginia and Maryland, within a radius of 15 or 18 miles. It is thought to have been present in the District of Columbia for four or five years, specimens of injured twigs, the injury of which was attributed to an unknown lepidopterous larva, having been received by the Bureau of Entomology in the fall of 1913. A few examples of injured twigs were received or collected during 1914 and 1915, but not until the fall of the latter year were the injuries at all common.

The larvæ have been found injuring twigs of the peach (*Amygdalus persica*), plum (*Prunus* spp.), and cherry (*Prunus* spp.), and the fruit of the peach, but the plum and cherry have not shown such general infestation as observed for the peach, which appears to be the insect's preferred food plant. However, flowering cherries in the parks in Washington are very generally infested. In one peach orchard observed by the authors, an examination in mid-September showed from 80 to 90 per cent of the twigs to have been injured. Its injuries to the twigs of bearing orchards, while important as interfering with normal growth, are of less significance than the injuries of the caterpillars to the fruit. Twig injury in nurseries, however, is of much more importance as the destruction of the terminal growing shoots results in the pushing out of shoots from lateral buds, producing a much-branched and bushy plant unsuitable for nursery stock.

Its attack on the twigs begins in the spring when the shoots are from six to eight in. long and continues until active growth of the tree ceases in the fall. As the twig hardens, the larva may leave its burrow and feed more or less on the exterior of the twig, cutting holes and pits into the bark and causing a copious exudation of gum, rendering the injury quite conspicuous. The larvæ prefer tender, actively growing shoots, and their injury to these is scarcely distinguishable from that of the common peach-twig borer or peach moth (*Anarsia lineatella*). The caterpillars pass from one shoot to another in search for appropriate food and several shoots may be injured by a larva in the course of its growth. The fruit may be attacked while quite green, the infestation increasing as it approaches maturity. In attacking the fruit the young caterpillars rather generally eat through the skin at or near the point of attachment of the fruit stem, the place being indicated by more or less frass adhering

to the surface of the fruit. Entrance is also made at other places, especially where the fruit has been punctured by the curculio or abrased by limbs or branches or other causes. Owing to the combined effect of the caterpillar and brown rot fungus, a good deal of fruit may fall to the ground, though the majority of the fruit infested by the caterpillars will remain hanging on the trees, especially if the fruit was invaded when nearly mature. The authors' observations are not conclusive as to whether the fruit is preferred to the twig.

The larvæ in general appear to be rather indiscriminate in their choice of pupation quarters and may be expected to choose any place on the trees where protection is afforded. The insect hibernates in the full-grown larval condition in silken cocoons, pupation occurring in the spring. Oviposition commences in the spring by the time the shoots of the peach are well out. There are two and probably three broods of larvæ each year.

A new mosquito from the eastern United States, F. Knab (*Proc. Biol. Soc. Wash., 29 (1916), pp. 161–163*).—A new mosquito from Laurence Harbor, N. J., is here described as *Culex brehmei*, and brief notes on its habits are included.

The fowl midge (Simulium nigritarsis), C. W. Mally (*Reprint from Cape Times Weekly [Cape Town], 1915, Oct. 29, folio*).—This simulid is said to cause a considerable loss of poultry in the Western Province. It becomes abundant when favorable weather conditions prevail, swarms on the fowls at night, and sucks their blood.

Egg disposal in Dermatobia hominis, F. Knab (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, pp. 179–183*).—The author presents further evidence to show that the female Dermatobia attaches its eggs to female mosquitoes of species which have a keen appetite for blood, and in such a manner that the larvæ hatch out and gain entrance to the host at the point at which the mosquito draws blood.

The tachinid genus Argyrophylax, W. R. Walton (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, pp. 189–192, figs. 4*).—Two male specimens reared from *Nacaleia indicata* at Rio Piedras, P. R., have been identified as *Argyrophylax albincisa*. A description given of the male is accompanied by drawings.

Notes on the larvæ of Euxesta notata, R. H. Hutchison (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, pp. 171–177, figs. 5*).—The author records the presence of large numbers of larvæ of this ortalid at Bethesda, Md., during May, June, and July, in swine dung, in accumulations made up largely of bran and other wastes from feed troughs, and in moist bran alone.

A monographic study of the parasitic Diptera of Africa, I, J. Rodhain and J. Bequaert (*Bul. Sci. France et Belg., 49 (1916), No. 3, pp. 236–289, pl. 1, figs. 14*).—The first section of this paper (pp. 238–262) deals with (*Muscina*) *Passeromyia heterochæta* and the larvæ of dipterous parasites of birds; the second section (pp. 262–289) with (*Cordylobia*) *Stasisia rodhaini*, the source of a cutaneous myiasis in man, its distribution, hosts, parasites, etc. A bibliography accompanies both sections.

Researches on the larvæ of cyclorrhaphous Diptera.—The life cycle of Pollenia rudis, parasite of Allolobophora chlorotica. Comparative biology of the larvæ of Diptera, D. Keilin (*Bul. Sci. France et Belg., 49 (1915), No. 1–2, pp. 15–198, pls. 16, figs. 26*).—The first part of this work (pp. 25–106) considers the parasitism of earthworms and the life cycle of the cluster fly (*P. rudis*). The second part (pp. 107–184) relates to the comparative biology of larvæ of the Diptera. In two appendixes the parasites of *P. rudis* and of oligochetes are considered. A bibliography of seven pages is included.

A preliminary note on the bionomics of Pollenia rudis in America, J. L. Webb and R. H. Hutchison (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, pp. 197–199*).—The authors here give a brief summary of the main points bearing di-

rectly on the natural history of the cluster fly (*P. rudis*), as reported by Keilin in the paper above noted. The life history of this fly, a species first discovered in America by the senior author at Washington, D. C., in June, 1916, has been found by the authors to be quite different in many ways from that in Paris, as described by Keilin.

The authors found the eggs of summer generations to hatch in about 3 days. The first stage larvæ are very active and appear to be able to penetrate the earthworms at almost any point in the body wall. The larvæ require from 13 to 22 days and the pupæ from 11 to 14 days to develop, and the total developmental period requires from 27 to 39 days. The authors have reached the tentative conclusion that there are four broods or generations per annum in the latitude of Washington, D. C.

A curious formation of a fungus occurring on a fly, L. O. HOWARD (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, pp. 196, 197*).—This note records the occurrence of a Cordyceps, possibly *C. dipterigena*, on a muscoid fly received from Fayetteville, Ark., and on two specimens in the Pergande collection.

A new parasite on sheep maggot flies, W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 27 (1916), No. 7, pp. 505, 506, pl. 1*).—A new chalcid found to parasitize blowfly maggots (*Calliphora oceaniæ*) before they pupate is described as *Chalcis calliphoræ.*

Ambrosia beetles or pin-hole and shot-hole borers, C. F. C. BEESON (*Indian Forester, 42 (1916), No. 4, pp. 216–223, pl. 1*).—This account includes lists of 11 species of Ipidæ and 9 species of Platypodidæ which have been found to attack the sal.

Forest longicorn beetles and their parasites, W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 27 (1916), No. 8, pp. 561–567, pls. 3*).—Several important Australian longicorn beetles, subsisting on gum timber, and their parasites are considered. Among them is *Phoracantha recurva*, parasitized by three species of braconids here described as new.

A new species of weevil injuring orchids, H. S. BARBER (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, pp. 177–179, pl. 1*).—*Cholus cattleyarum*, reared from Cattleya orchids probably from Colombia, Venezuela, or northern Brazil, which has been the source of injury to orchids in greenhouses at Washington, D. C., and Milwaukee, Wis., is here described as new to science.

Pristocera armifera parasitic on Limonius agonus, J. A. HYSLOP (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, pp. 169, 170, pl. 1*).—The author records the rearing of this bethylid parasite from a wireworm (*L. agonus*) from material collected in July, 1915, during the course of a serious infestation of corn near Brattleboro, Vt.

Notes on Dianthidium arizonicum, W. MIDDLETON (*Proc. Ent. Soc. Wash., 18 (1916), No. 3, pp. 193–195, pl. 1*).

FOODS—HUMAN NUTRITION.

Dietary deficiencies of the maize kernel, E. V. MCCOLLUM, N. SIMMONDS, and W. PITZ (*Jour. Biol. Chem., 28 (1916), No. 1, pp. 153–165, figs. 10*).—A series of experiments with laboratory animals (rats) are reported in which single or multiple additions of purified substances were made to a diet of ground maize. The substances added were protein, inorganic salts, and butter fat, to supply the unidentified dietary factor, "fat-soluble A." It had been found in earlier experiments that the dietary factor "water-soluble B" is furnished in abundance by even 70 per cent of maize in the diet. The following conclusions are drawn in part from the data reported:

"The proteins of the maize kernel contain all the amino acids essential for growth but the proportions of certain of them are such that they are not utilizable to a high degree as the sole source of protein. When other factors affecting nutrition were properly adjusted, . . . growth [took place] at about two-thirds the normal rate, over a period of six or seven months, on a diet in which all the protein was derived from 91 per cent of ground maize in the ration."

The maize kernel contains both "fat-soluble A" and "water-soluble B," but the former is present in too small an amount for the maintenance of growth at the maximum rate in rats. If the maize diet is supplemented with an alcoholic extract of maize containing the "fat-soluble A," growth is induced which more closely approximates the normal than without this addition, and this was followed by reproduction and rearing of the young.

The inorganic content of the corn kernel is not of suitable character for the promotion of growth, and it was necessary to make salt additions to rations deriving their inorganic content from maize before growth could take place. The authors state that it is evident from experiments carried out thus far, that it is not easy, if at all possible, to make up a satisfactory ration wholly derived from the corn kernel and its parts.

The effects of feeding the proteins of the wheat kernel at different planes of intake, E. V. McCollum, N. Simmonds, and W. Pitz (*Jour. Biol. Chem., 28 (1916), No. 1, pp. 211–229, figs. 17*).—In this paper the authors attempt to throw some light upon the problem of whether an animal is as well off physiologically with a ration otherwise satisfactorily constituted but containing a high content of protein of low value as when given the same food mixture with the low grade protein replaced by its biologically equivalent amount of a much better protein. These experiments, like others in which a diet high in wheat content was fed, emphasized the marked injury to the progeny resulting from such restricted diets. The authors were not able to make up a ration, containing wheat protein only, which was adequate for the rearing of the young.

"The addition of 10 per cent of casein to a ration which contained 36.33 per cent of protein from wheat, and which was satisfactory with respect to all dietary factors other than protein and an inherent toxicity, improved the ration in a marked degree. Growth was not interfered with by the inclusion of as much as 40.45 per cent of wheat proteins in the diet, but on this the young could not be reared.

"Growth was normal and the production of young was good on a diet containing 46.63 per cent of protein, of which 43.0 per cent was casein, and 3.63 per cent of wheat proteins. The cause of the failure to rear the young on this diet has not yet been definitely ascertained, but would appear to be due in great part at least to the shortage of the supply of the dietary factor 'B,' the sole source of which was the 33 per cent of wheat in the food mixture. As small an amount as 15 per cent of whole wheat as the source of the 'water-soluble B,' suffices for the completion of growth in the rat and so promotes well-being as to induce the production of a nearly normal number of young. The amount of this substance is not great enough to enable the young to develop to weaning age without causing pronounced nervous disturbances which end in death."

The drying for milling purposes of damp and garlicky wheat, J. H. Cox (*U. S. Dept. Agr. Bul. 455 (1916), pp. 11, figs. 3*).—This bulletin reports data showing the proper temperature at which wheat should be dried for milling purposes, obtained in connection with investigations to determine the best method of artificially drying, cleaning, and handling garlicky wheat for mill-

ing. Milling and baking tests made upon samples of the garlicky wheat and damp wheat free from garlic dried at different temperatures indicated that 140° F. is probably the most satisfactory temperature for the drying of the wheat, either with or without garlic, for milling purposes.

"More exensive experiments may show that wheat can be dried at a higher temperature than 140° without having a bad effect on the flour. Every test except one where the wheat was dried at 180° and above gave poorer results in the baking test from the standpoint of loaf volume and texture than when dried at 140°.

"If wheat is dried down to 9 per cent of moisture or below for the removal of garlic, great care must be taken in tempering it back to the normal amount of moisture. In order to restore the moisture content of the dried wheat to normal, which is important for good milling, the wheat should be tempered at least twice, and more if necessary. After the wheat is tempered it should be stored several hours before mixing or before another tempering is made, in order to allow the moisture to penetrate into the kernel. Several hours after the last tempering the wheat should be run from the bin and a thorough mixture made. This last process assists in mixing the dry and wet spots and makes a more even mixture at the rolls."

Skim milk in the nutrition of adults, G. Moussu (*Compt. Rend. Acad. Agr. France, 2 (1916), No. 35, pp. 1016–1023*).—Regulations are prescribed for the sale of skim milk. These forbid the sale of whole and skim milk by the same dealer and require plain labeling and separate transportation of the skim milk. A special warning is given against the use of skim milk in place of whole milk for feeding very young children.

Chinese preserved eggs—pidan, Katharine Blunt and C. C. Wang (*Jour. Biol. Chem., 28 (1916), No. 1, pp. 125–134*).—This paper reports the results of an analysis of a kind of Chinese preserved eggs, called "pidan." The substance is a factory product from ducks' eggs and is prepared by covering the eggs with a mixture of lime, salt, water, ashes, and a tea infusion, after which they are stored for five months and then given a further coating of rice hulls.

During the formation of pidan from fresh ducks' eggs a transfer of large quantities of water from the white to the yolk and a loss of water from the white to the outside took place. The ash and the alkalinity of the ash increase, as in the case of other eggs preserved in alkali. The ether extract decreased and its acidity was high. A decrease was also noted in the total and lecithin phosphorus. The noncoagulable nitrogen increased as well as the ammoniacal nitrogen and the amino nitrogen was high in the product.

The conclusion is drawn from the chemical changes undergone that decomposition of the egg protein and the phospholipoids has taken place. The production of pidan is said to be probably brought about through the agency of alkali, bacteria, and enzyms.

Flavoring extracts, C. H. Lawall and L. Forman (*Penn. Dept. Agr. Bul. 285 (1916), pp. 35*).—Data are reported regarding the examination of over 200 samples of different flavoring extracts.

[Food and drug inspection], E. F. Ladd and Alma K. Johnson (*North Dakota Sta. Spec. Bul., 4 (1916), No. 8, pp. 179–194*).—Data are reported regarding a number of samples of miscellaneous foods, drugs, and patent medicines. A few notes on miscellaneous food topics are included, together with a brief paper on The Laboratory Examination of Drinking Waters by R. Hulbert, which discusses its scope, purpose, and the interpretation of results.

Twelfth annual report of the dairy, food, and oil commissioner, M. GROSHON (*Ann. Rpt. Dairy, Food and Oil Comr. Wyo., 12 (1916), pp. 105*).—This contains information regarding a large number of samples of miscellaneous foods analyzed. The report of T. S. Parsons, seed analyst, is also included.

The economical ration for the times, C. BOLDUAN (*Sci. Amer., 115 (1916), No. 24, p. 529*).—This article describes a dietary worked out by the New York City Department of Health for a family of two adults and three minor children for one week, at a cost of $7.86. Several suggestions are also given as to ways in which cheaper foods may be substituted for more expensive ones.

Schoolhouse meeting discussion of how to feed the family for health and efficiency, JESSIE P. RICH (*Bul. Univ. Tex., No. 68 (1915), pp. 18, figs. 5*).—A popular bulletin in which 11 questions regarding the diet are answered.

The feeding of prisoners and sanitary conditions in German camps, A. C. GUILLAUME (*Rev. Sci. [Paris], 54 (1916), II, No. 20, pp. 619–624*).—The average daily ration at Holzminden is given as protein, about 55 gm.; fat, 15 gm.; and carbohydrate, 272 gm.; with an average energy value of 1,492 calories.

[Food of the natives of Mailu, British New Guinea], B. MALINOWSKI (*Trans. Roy. Soc. So. Aust., 39 (1915), pp. 546–553, figs. 8*).—A part of a report on the natives of Mailu. Information is given regarding the nature of the food and its preparation and cooking. A number of utensils are also described.

The control of hunger in health and disease, A. J. CARLSON (*Chicago: University of Chicago Press, 1916, pp. VII+319, figs. 39*).—This book summarizes the laboratory work during the last four years of the author and others on the stomach, with special reference to hunger and appetite. The subjects discussed are the biological significance of hunger, the stomach in hunger, some accessory phenomena in hunger, the relation of hunger to appetite, the sensibility of the gastric mucosa, hunger and age, hunger in prolonged starvation, the nervous control of the hunger mechanism, the chemical control of the hunger mechanism, secretion of appetite gastric juice in man, the chemistry of human appetite gastric juice, and hunger and appetite in disease. A bibliography is included.

Results of studies on vitamins and deficiency diseases, during the years 1913–1915, C. FUNK (*Biochem. Bul., 4 (1915), No. 14–15, pp. 304–364, fig. 1*).—This article is a summary and digest of experimental data relative to these subjects, which have been published since the appearance of the author's book (E. S. R., 32, p. 578). The subjects considered are beri-beri, scurvy, pellagra, sprue, rickets, the chemistry and physiology of growth, etc. An extended bibliography is appended.

The transmissibility of pellagra.—Experimental attempts at transmission to the human subject, J. GOLDBERGER (*Pub. Health Rpts. [U. S.], 31 (1916), No. 46, pp. 3159–3173*).—The investigation here reported is in continuation of earlier work by the author (E. S. R., 34, p. 258). Material (blood, nasopharyngeal secretions, epidermal scales from pellagrous skin lesions, urine, and feces) from 17 severe cases of pellagra was administered to the volunteer subjects of the experiments (16 humans), who afterwards continued their customary habits of life and diet. Observations of the subjects during a period of five to seven months showed that none has developed evidence justifying the diagnosis of pellagra. The author states that, in his opinion, "these experiments furnish no support for the view that pellagra is a communicable disease; they materially strengthen the conclusion that it is a disease essentially of dietary origin, brought about by faulty, probably 'deficient,' diet."

Experimental scurvy produced in guinea pigs by milk and milk products, J. J. MOORE and LEILA JACKSON (*Jour. Amer. Med. Assoc., 67 (1916), No. 26, pp. 1931–1935*).—In these experiments one group of the guinea pigs was fed upon

milk which had been pasteurized by heating to 140° F. for from 25 to 30 minutes, another group was fed upon raw certified milk, and a third was given milk which had been boiled for 10 to 15 minutes. Symptoms of scurvy were produced in most of the animals receiving an exclusive diet of raw, pasteurized, boiled, or skim milk. A severe form of the disease was produced in the animals by condensed milk, casein and water, and several proprietary infants' foods.

A large number of the animals were also fed upon carrots, cabbage, lettuce, and other green vegetables, with hay, for long periods. Symptoms of scurvy were not observed when such a mixture of foods was given, but scurvy was produced in nearly all the young animals when milk was added to these diets of green vegetables. This was rarely true in the case of the older animals.

From a comparison of the results of this investigation with those of other workers, it would appear that a ration which may be entirely adequate in nutritive value for one species may be inadequate for another. "While there is a marked individual variation toward diets in each species, the species variation is still greater."

The paper is followed by a discussion.

Changes in the urea content of blood and tissues of guinea pigs maintained on an exclusive oat diet, H. B. LEWIS and W. G. KARR (*Jour. Biol. Chem., 28 (1916), No. 1, pp. 17–25*).—Laboratory animals (guinea pigs), which developed the so-called "scorbutus" as a result of an exclusive oat diet, showed a urea content several times greater than the normal amount. When small amounts of cabbage or oranges were added to the diet, no pathological conditions developed for periods of from 28 to 42 days in the case of the cabbage and 24 to 63 days in the case of the oranges. Analyses of blood and tissues showed a normal urea content. The addition of sodium citrate to the oat diet did not influence the changes resulting from the exclusive oat diet. The changes in the urea content of the organism are not attributed to partial starvation or to lack of water alone, although these factors may be involved to some extent.

The mechanism of the sparing action of carbohydrates on protein metabolism, R. A. KOCHER (*Jour. Biol. Chem., 25 (1916), No. 3, pp. 571–576*).—Experiments with laboratory animals (dogs) were undertaken to determine the sparing effect upon the output of nitrogen and of the ingestion of lactic and pyruvic acids as compared with the sparing action of equivalent amounts of undissociated carbohydrates. The acid or cane sugar was administered by stomach tube to fasting dogs after the elimination of nitrogen had become constant, and following this determinations were made of the nitrogen excreted in the urine.

The sparing action of lactic acid on protein metabolism was practically the same as that of carbohydrates. That of pyruvic acid, however, was distinctly less. The author states that one of the chief intermediate steps in the dissociation of glucose in the body is the formation of lactic acid, which can be oxidized in the body to pyruvic acid. Also, that lactic acid and pyruvic acid can add on ammonia nitrogen to form alanin, and "when this process is operative, nitrogen arising from catabolism of body proteins, instead of being excreted, is utilized to synthesize new protein." Although the above reactions are reversible, the normal catabolism of glucose gives rise to simpler molecules, which may, in part, be combined with nitrogen to synthetize protein.

These experiments tend to support the theory that the fixation of catabolized nitrogen, by the dissociation products of glucose to form new proteins, is the true mechanism of the sparing effect of feeding carbohydrates on the nitrogen output.

The effect on nitrogen partition of substituting alcohol for sucrose in an otherwise fixed diet, F. S. HAMMETT (*Jour. Biol. Chem., 25 (1916), No. 3, pp.*

601–605).—Experiments with two men accustomed to a moderate use of alcoholic beverages showed that the substitution, in an otherwise fixed diet, of alcohol for isodynamic amounts of sucrose yielding about 370 calories of energy, produced no significant changes in urinary nitrogen partition.

Concerning the utilization of inosit in the animal organism, I, II (*New York State Sta. Tech. Bul. 54* (*1916*), *pp. 3–16; Jour. Biol. Chem., 25* (*1916*), *No. 3, pp. 391–407*).—Two papers are presented.

I. *Concerning the effect of inosit upon the respiratory exchange in the dog*, R. J. Anderson.—The work of other investigators having shown that inosit given per mouth is either largely destroyed by bacteria in the intestine or else oxidized in the body, determinations were made of the respiratory quotient of laboratory animals (dogs) which in a fasting condition were fed inosit just previous to the experiment, in order to throw further light upon the fate of inosit in the animal organism. The experiments showed that inosit was not utilized to any extent by the dog, and that it was not stored or oxidized in the body, the greater part (as much as 77 per cent of the amount given) being excreted unchanged. When given per mouth at the rate of 2 gm. per kilogram of body weight no rise in the respiratory quotient was noted. Only a small portion of the inosit was found to be excreted by the kidneys.

II. *The effect of inosit upon the metabolism of man*, R. J. Anderson and A. W. Bosworth.—Experiments were made with human subjects to determine whether the ingestion of inosit influences the metabolism of man, as shown by the nitrogen and phosphorus excretion, and also to study the fate of inosit in the human body and its channels of elimination. The results of this investigation are summarized by the authors as follows:

"It is shown that when inosit is taken at the rate of about 0.5 gm. per kilogram of body weight per day it produces some diarrhea at first or frequent soft stools. After a few days the stools, although more frequent than usual, are nearly of normal consistency.

"Except for the increased excretion of creatinin in the after period, for which we can now offer no explanation, we find that the ingestion of inosit has no marked or appreciable effect upon the general metabolism of man. About 9 per cent of the inosit taken per os is eliminated unchanged in the urine, but none in the feces. In what manner the balance, or about 91 per cent, of the inosit is utilized we have not been able to determine."

The distribution of the lipoids ("fat") in human blood, W. R. Bloor (*Jour. Biol. Chem., 25* (*1916*), *No. 3, pp. 577–599*).—The data reported in this paper are based upon complete analyses of the lipoids in the blood of 23 normal and 25 abnormal individuals. The author states that the term lipoids "is used as a general term for all those substances connected with the metabolism of the fatty acids, including the fatty acids, their naturally occurring compounds, and such substances as cholesterol which occur naturally in combination with the fatty acids and which are therefore presumably connected with their metabolism."

A bibliography is appended.

The urinary and fecal output of calcium in normal men together with observations on the hydrogen ion concentration of urine and feces, C. F. Nelson and J. L. Willaams (*Jour. Biol. Chem., 28* (*1916*), *No. 1, pp. 231–236*).—From observations made during five days upon five normal male individuals, ranging from 13 to 70 years of age, the extreme daily variations in the output of calcium (calculated as oxid) were found to be in the urinary excretion from 0.1754 to 0.6186 gm. and in the fecal excretion from 0.4125 to 0.801. The subjects of the experiments were maintained upon a mixed diet, which was in no way modified or restricted for the purpose of the experiment.

The calcium and magnesium content of normal urine, C. F. NELSON and W. E. BURNS (*Jour. Biol. Chem., 28 (1916), No. 1, pp. 237–240*).—Data are reported regarding the calcium and magnesium content of the urine of 25 apparently normal individuals on an ordinary mixed diet. The results are summarized by the authors as follows:

"The average daily output of calcium and magnesium (calculated as oxid) for five-day periods varied in the cases studied from 0.1685 to 0.1468 gm. of calcium, and 0.1912 to 0.313 gm. of magnesium.

"The daily output of calcium and magnesium of 25 apparently healthy individuals showed 17 in which calcium was excreted in larger amounts than magnesium, and 8 in which magnesium predominated over calcium. The largest amount of calcium (calculated as oxid) excreted in 1 day was 0.4875 gm.; magnesium (calculated as oxid), 0.416 gm. The smallest amount of calcium was 0.099 gm.; magnesium, 0.118 gm.

"Either calcium or magnesium may be excreted by way of the urine in the larger amount in the normal individual. Whichever element predominates does so constantly, or very nearly so, and seems to be independent of the character of the food ingested."

Contribution to the knowledge of the enzyms of the large intestine, D. MAESTRINI (*Arch. Farmacol. Sper. e Sci. Aff., 22 (1916), Nos. 11, pp. 391–416; 12, pp. 417–428, figs. 2*).—The work of other investigators is reviewed and experiments are reported with laboratory animals (dogs, sheep, etc.).

The author concludes that in the proximal colon the processes taking place differ from those in the other portion of the colon. The proximal colon apparently does not contain a proteolytic ferment similar to trypsin or pepsin but does, however, contain a peptolytic ferment. In the colon of the dog there is a lipase which is not present in that of the sheep. In the case of the dog and the sheep there is present in the first portion of the colon a ferment which breaks down starch. Nitrogen is also present in the colon of both these animals.

ANIMAL PRODUCTION.

International catalogue of scientific literature. L.—General biology (*Internat. Cat. Sci. Lit., 9 (1912), pp. VIII+117; 10 (1913), pp. VIII+138; 11 (1913), pp. VIII+130; 12 (1914), pp. VIII+111; 13 (1916), pp. VIII+93*).—These numbers continue the catalogue previously noted (E. S. R., 24, p. 670). The primary divisions catalogued are general biology, methods and apparatus, general morphology, general physiology, and general cytology.

Experimental studies on growth.—VIII, The influence of a diet deficient in fats, and of the same diet with cholesterol added, upon the growth of the white mouse, T. B. ROBERTSON (*Jour. Biol. Chem., 27 (1916), No. 2, pp. 393–402, figs. 3*).—Continuing the studies previously noted (E. S. R., 35, p. 864), the author reports experiments in which a diet composed of boiled and mashed potatoes, defatted bran, and white of egg, with the addition of small amounts of chlorophyll and ferric chlorid, was fed to mice four or five weeks of age.

The feeding of this diet led to an initial loss of weight, followed by a resumption of the retarded growth. A sharp decline in weight, accompanied by a hyperirritability of the skin and terminating in death, was the ultimate result.

"The addition of cholesterol to the above diet prevents the initial loss of weight, but does not otherwise improve the welfare of the animals, the average duration of life of the animals receiving cholesterol being actually less than that of the animals which do not receive cholesterol. It follows that although growth is possible on the diet described, maintenance of the tissue gained is not. Decline of weight therefore occurs at an age when the diminishing velocity of

growth has become insufficient to compensate for the deficient ability of the tissues to replace their current loss. The variability of animals fed upon the diets described, as is probably to be expected under any unfavorable environmental or dietetic conditions, instead of falling with increasing age and slackening of growth, maintains a high level throughout the life of the animals."

Net energy values for ruminants, H. P. ARMSBY and J. A. FRIES (*Pennsylvania Sta. Bul. 142 (1916), pp. 3–14*).—This paper gives in brief form the results of investigations noted from another source (E. S. R., 33, p. 72).

Net energy values of American feeding stuffs, H. P. ARMSBY and F. S. PUTNEY (*Pennsylvania Sta. Bul. 142 (1916), pp. 15–20*).—Basing their calculations on methods described in the above paper, the authors have computed the net energy values of a number of feeding stuffs from the tables of Henry and Morrison (E. S. R., 34, p. 261). The results are here tabulated, together with the digestible protein and the nonprotein of the feeding stuffs.

War feeding stuffs, M. POPP (*Zent. Einkaufsgesell. Beschränkt. Haftung, Flugschr. No. 6 [1915], Orig., pp. 20, figs. 2*).—This pamphlet briefly discusses the use of various green feeds and roughage, the feeding stuffs produced in the forest, fruits and seeds, and various waste products. Several feeds not recommended for use are also briefly discussed.

The industrial manufacture of war feeding stuffs, M. POPP (*Zent. Einkaufsgesell. Beschränkt. Haftung, Flugschr. No. 7 [1915], Orig., pp. 16*).—This pamphlet discusses the preparation and use of straw meal, hay meal, wood meal, a processed straw meal (made by treatment with dilute alkali), lupine flakes (the alkaloids being removed by aqueous extraction), chestnut flakes, potato press cake, air-dried potatoes, kitchen waste, and yeast.

Cotton-seed meal as an incomplete food, C. A. WELLS and P. V. EWING (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 15–25*).—The experiments here reported are supplementary to previous work (E. S. R., 35, p. 383). From the results obtained it is concluded that cotton-seed meal is an incomplete food, even when fed with sugar and starch on a wide nutritive ratio.

"Pigs upon an absolute maintenance diet ate in addition only small quantities of cotton-seed meal and were not greatly injured by it.

"So-called cotton-seed meal injury is due in large part to inadequate diets."

Chemical composition, digestibility, and feeding value of vegetable-ivory meal, C. L. BEALS and J. B. LINDSEY (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 7, pp. 301–320*).—This is a report of investigations at the Massachusetts Experiment Station upon the chemical composition, digestibility, and feeding value of vegetable-ivory meal. This is the waste product in the manufacture of "vegetable ivory," the seed or nut of the palm-like plant *Phytelephas macrocarpa* (E. S. R., 30, p. 46).

The vegetable-ivory meal used in these experiments was medium fine, white in color with occasional flecks of particles of the brown outer coating of the nut, tasteless, odorless, and very hard. Analyses of nine samples of vegetable ivory showed an average of 11.39 per cent moisture, 4.63 per cent protein, 0.92 per cent fat, 75.09 per cent nitrogen-free extract, 6.89 per cent fiber, and 1.08 per cent ash. Considerable variations were found in the composition of the different samples. The protein rarely exceeded 5 per cent, and was found to contain about one-third of its nitrogen in the amido form. Lignin, galactin, starch, and dextrose were not detected in any of the samples. The nitrogen-free extract was composed principally of mannan, with small amounts of pentosans and of a substance insoluble in alcohol but not identical with the pectin substances usually found in plants. The calorific value of the meal was determined as 1,717 large calories per pound, which compares favorably with that of corn meal, sugar, and corn starch.

In digestion experiments sheep readily ate a mixture of English hay, gluten meal, and finely ground vegetable ivory, 10:3:4 by weight. The average percentage digestibility of vegetable-ivory meal in two experiments in which five sheep were involved was dry matter 84, protein 36, fat 51, fiber 72, and nitrogen-free extract 92. As another means of testing the digestibility of vegetable-ivory meal an experiment was conducted with sheep in which a basal ration of hay and gluten feed was compared with a ration of the same feeds in like quantities plus 200 gm. of vegetable-ivory meal. Each ration was fed for 14 consecutive days and the feces were collected for the last seven days in each period. The feces were tested for total sugar after acid hydrolysis, to note whether the percentage of sugar was higher in the ivory-meal period than in the period without the meal. On a dry-matter basis it was found that the average carbohydrate content, estimated as dextrose, for the feces of the hay, gluten, and ivory-meal period was 25.46 per cent and that for the hay and gluten period was 24.68 per cent. From these results it is concluded that very little of the carbohydrate of the vegetable-ivory meal escaped undigested.

In feeding experiments with cows vegetable-ivory meal was compared with corn meal. In one experiment three pairs of cows were fed on the reversal plan for periods of 5 weeks each a basal ration per cow daily of about 2.5 lbs. of wheat bran, 2.5 lbs. of cotton-seed meal, and 20 lbs. of hay. In addition either 3 lbs. of vegetable-ivory meal or 3 lbs. of corn meal were fed. During the 70 days the cows gained in weight an average of 15.6 lbs. each on the corn meal ration and 1 lb. each on the vegetable-ivory meal ration. During the 35 days the 6 cows were fed the corn meal ration they produced 5,243.5 lbs. of milk, containing 701 lbs. of solids and 239.2 lbs. of fat; and during the 35 days on the vegetable-ivory meal ration they produced 5,072.7 lbs. of milk containing 681.3 lbs. of solids and 236.1 lbs. of fat.

In another test with three cows in which a basal ration somewhat below that needed for maintenance and milk production was used the addition of 3 lbs. per cow daily of vegetable-ivory meal for two weeks increased the milk flow 5.7 per cent. When the cows were returned to the basal ration the milk decreased 4.2 per cent. In another test in which a basal ration with and without vegetable-ivory meal was fed for 81 days the addition of the meal was followed by an increase in milk flow and its removal by a decrease in milk flow.

In another experiment six cows were fed for eight weeks, exclusive of a preliminary period of ten days, a low basal ration of hay, wheat bran, cotton-seed meal, and hominy. In addition three of the cows were fed 2.79 lbs. of vegetable-ivory meal each daily during the first four weeks and the other three cows a like amount of vegetable-ivory meal during the second four weeks. On the basal ration plus vegetable-ivory meal, the six cows produced 3,959 lbs. of milk containing 534.61 lbs. of solids and 190.02 lbs. of fat; and on the basal ration alone they produced 3,826.6 lbs. of milk containing 492.49 lbs. of solids and 179.84 lbs. of fat.

In another experiment eight cows were fed by the reversal system, each period continuing five weeks. Hay, bran, and cotton-seed meal composed the basal ration to which were added like amounts of dry matter in the form of corn meal and vegetable-ivory meal, i. e., 4.01 lbs. daily per cow of corn meal and 3.75 lbs. daily of vegetable-ivory meal. During the experiment the cows on the ration containing corn meal lost 38 lbs. in weight as compared with a loss of 95 lbs. on the ration containing ivory meal. On the corn meal ration the cows produced 6,931.3 lbs. of milk containing 935.85 lbs. of solids and 337.72 lbs. of fat, and on the vegetable-ivory meal ration they produced 6,403.3 lbs. of milk containing 862.23 lbs. of solids and 315.83 lbs. of fat.

From these experiments the authors conclude that vegetable-ivory meal does not fully equal corn meal for milk production.

Composition and food value of blood meal, N. HANSSON (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 128 (1916), pp. 14; K. Landtbr. Akad. Handl. och Tidskr., 55 (1916), No. 3, pp. 218–229*).—The results of a number of feeding experiments with hogs indicate that blood meal containing from 75 to 80 per cent of protein should be fed in small quantities as a supplementary feed. From 0.6 to 0.7 kg. was readily consumed by a hog per day.

When fed to cattle only about 0.1 kg. per animal per day should be fed at the beginning, and the quantity gradually increased to about 0.75 kg. per day.

In feeding hogs 0.65 kg. of blood meal was equivalent in food value to 1 kg. of corn. The meal proved to be more beneficial during the growing period of hogs than during the fattening period. The animals fed on the blood meal were not so fat as those fed on corn.

No difference in the meat of the experimental and control animals was observed.

Investigations on the growth of reindeer moss, K. NISSEN (*Tidsskr. Norske Landbr., 23 (1916), No. 2, pp. 49–64, figs. 7*).—Investigations on the growth of reindeer moss have been begun by the author at Langensjöen, Stenfjeldt, and Flensmarken, but on account of the slow growth of the moss no results are expected on the experimental fields before the lapse of from 10 to 15 years.

Feeding dairy calves in California, F. W. WOLL and E. C. VOORHIES (*California Sta. Bul. 271 (1916), pp. 17–44, figs. 10*).—This bulletin reports results of feeding experiments with calves conducted at the University Farm during the past two years to supply information on the value of linseed meal in various grain mixtures for skim-milk calves; carob pods *v.* barley, and dried beet pulp *v.* coconut meal as components of grain mixtures for such calves. A progress report of these tests has already been noted (E. S. R., 34, p. 265). The bearing of the results of these experiments on calf feeding problems in the State is discussed, and general information is given relating to the subject of raising calves. The results of chemical analyses of the feeds used in the tests and the digestible components of the feeds on the basis of available digestion coefficients are tabluated.

The calves in each of the lots were fed in addition to the grain mixtures from 10 to 25 lbs. daily of separator skim milk and alfalfa hay ad libitum, except that some whole milk was fed in test 4, and some of the calves in test 5 were fed dry feed only during the latter part of that test. The grains were fed ground or rolled in amounts varying from less than 0.5 lb. to more than 2 lbs. per head daily. Some of the results obtained are shown in the following table:

Results of calf feeding tests.

Test.	Lot.	Kind of ration.	Number of calves.	Length of test.	Average age at beginning.	Average daily gain per head.	Feed cost per pound of gain.
				Days.	*Days.*	*Lbs.*	*Cts.*
I	1	Barley, oats, wheat middlings, linseed meal (2 : 2 : 2 : 1)	8	70	41	1.13	5.0
	2	Barley, oats, wheat middlings (1 : 1 : 1)	7	70	36	1.21	5.0
II	1	Barley, milo maize, and linseed meal (3 : 2 : 1)	8	77	101	2.00	4.4
	2	Barley and milo maize (3 : 1)	7	77	95	2.03	4.2
	3	.....do	8	77	42	1.45	3.8
III	......	Barley, shorts, linseed meal (3 : 2 : 1)	5	112	69	2.48	4.2
IV	1	Carob pods, milo maize (1 : 1)	8	91	28	1.81	8.9
	2	Barley, milo maize (1 : 1)	6	91	30	1.70	8.7
V	1	Beet pulp, barley (1 : 2)	7	70	122	2.08	5.8
	2	Coconut meal, barley (1 : 2)	7	70	123	1.84	6.3

One calf of lot 2 of the first and second tests is not included in the above table on account of unsatisfactory gains due to constitutional weakness.

In order to test the residual effect of feeding linseed meal the calves in lots 1 and 2 of test 2 were put on pasture without extra feed at the close of the experiment. The average daily gains per head for 160 days on pasture were 1.6 lbs. for lot 1 and 1.59 lbs. for lot 2.

The object of test 3 was to ascertain the gains that may be secured by heavy feeding of skim-milk calves. The daily rations per head in this experiment averaged 2 lbs. of grain, 14.3 lbs. of skim milk, and 7.3 lbs. of alfalfa hay.

The pods from the carob tree (*Ceratonia siliqua*) used in test 4 were crushed in the ordinary machinery used in rolling barley or oats. The crushed pods were greatly relished by the calves. The high cost of gains in this test were due to the fact that whole milk was fed during the first part of the experiment, some of the calves being too young for skim milk. The average daily gains during the last half of this experiment, when skim milk was fed, were 1.87 lbs. for lot 1 and 1.79 lbs. for lot 2, the feed cost per pound of gain being 4.5 cts. and 4.4 cts., respectively.

Charts are given showing the weekly gains of the different lots in each experiment.

Feeding calves with skim milk and partially hydrolyzed starch, H. Edin (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 124* (*1915*), *pp. 40, fig. 1; K. Landtbr. Akad. Handl. och Tidskr., 55* (*1916*), *No. 1–2, pp. 83–120, fig. 1*).—Experiments are reported in detail in which a ration prepared as follows was fed to calves with excellent results: Ten kg. of oatmeal was mixed with poor wheat, rye flour, or corn meal, moistened with water, and allowed to soak through the night. Next morning 15 liters of skim milk and as much water were added and the mixture heated to 100° C., with constant stirring to avoid the formation of lumps. The mass was cooled to about 60°, and finely ground brewery malt, previously prepared by mixing 1 kg. of malt with 2 liters of skim milk and carefully warming to 60°, added. The entire mixture was kept at a temperature of from 55 to 60° for some little time and stirred occasionally to prevent any formation of lumps. It was then made up to a volume of 50 liters with skim milk and fed to the animals. The material could be safely preserved with formalin in the proportion of 1:10,000 for later feeding.

Another feed which yielded excellent results was prepared by mixing 1 kg. of skim milk, 50 gm. of starch, 10 gm. of 1 per cent formalin, 2 gm. of chalk, and 1 gm. of salt. The milk was sterilized for 15 minutes by heating to 85°, after which the starch and other materials were added. For partially converting the starch into sugar a suitable quantity of diastase was added.

Value of alfalfa and other green feed in hog raising, N. Hansson (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 123* (*1915*), *pp. 29, fig. 1; K. Landtbr. Akad. Handl. och Tidskr., 55* (*1916*), *No. 1–2, pp. 30–56, fig. 1*).—Experiments in hog feeding are reported covering a period of five years with alfalfa combined with skim milk and corn, and with green oats and clover combined with alfalfa.

The results indicate that green feed cut in an advanced stage of development is a good feed for hogs which are being fattened, though its use is not so desirable for young growing pigs. Green fodder should be added to other feed in amounts of from 20 to 22 per cent, and even in greater amounts for suckling mothers. Its food value depends to a large degree on the season in which it is cut, being highest in the summer and autumn. From 7 to 7.5 kg. of alfalfa were equivalent to 1 kg. of corn. Green clover had about the same food value as alfalfa but was not so convenient to use. Green oats, having a lower content of dry matter than alfalfa and clover, has a smaller food value,

from 9 to 10 kg. being equivalent to 1 kg. of corn. The food value of the alfalfa and clover was not increased by cutting or by fermentation and cooking, the only advantage of these procedures being that greater quantities of the fodder are consumed by the hogs. The best results were obtained by gradually increasing the amount of green fodder until the fattening hog had developed a mean weight of from 70 to 80 kg., and then decreasing the amount during the last period of fattening.

The green feed had no influence whatever on the quality of the meat of the animals.

Horse beans were eaten greedily by the hogs and seemed to exert an excellent influence on their growth.

Long-bodied brood sows, E. N. WENTWORTH (*Breeder's Gaz., 70 (1916), No. 12, pp. 470, 471*).—In experiments at the Kansas Agricultural College 10 large type Poland-China, 2 Berkshire, and 16 Duroc-Jersey sows were divided with reference to body length into the grades very long, long, medium long, medium short, and short. Twenty-one of the sows were in the long grades and seven in the short grades, and all were two-year-olds or over.

The average size of litter for the three grades of long-bodied sows was 9.24 pigs, while the number raised on the average was 5.71 pigs. The average size of litter from the two grades of short-bodied sows was about the same, 9.29 pigs, but the proportion raised was much greater than that of the long-bodied sows, the litters averaging 7.57 pigs at weaning. "One can not say that a medium to short body is desirable as a result of this study, but he can suspect that body length is unrelated to fertility."

Breeding studies of the large white English hog, C. WRIEDT (*Slegtskapsavlen hos det Store Hvite Engelske Svin. Christiania: Gröndahl & Sons, 1915, pp. 116, pls. 4, figs. 33*).—This manual deals with the wild ancestors of pigs, the original English pig, the Indo-Chinese and Neapolitan pig in England, imported in the sixteenth and seventeenth centuries, and the development and breeding of the leading strains of Large White Yorkshire pigs, including illustrations and pedigrees.

Correlation between the size of cannon bone in the offspring and the age of the parents, C. WRIEDT (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 8, pp. 361–371, figs. 5*).—In the investigations here reported, which were conducted at the Illinois Experiment Station, data were collected from measurements of mares recorded in the studbook of the Gudbrandsdal breed of horses of Norway. The measurements were taken of the circumference of the cannon bone near its center at the narrowest point. Causes other than age which have an influence on the size of the cannon bone of the offspring are briefly discussed.

On the basis of measurements of 2,951 mares it was found that the average size of the cannon bone decreases slightly as the age of the sires increases. It was also found that mares whose cannon bones measure more than 19.5 cm. more likely came from sires under 11 years of age than mares whose cannon bones are under 19.5 cm. Investigation was made of the daughters of 10 selected stallions, each of which had more than 25 registered daughters, of which at least 10 were sired before or after the stallion was 10 years old. The average size in centimeters of the cannon bones of 300 mares sired before the stallions were 10 years old was 19.448 ± 0.026 and of 262 mares sired by stallions over 10 years old was 19.232 ± 0.027.

The correlation between the age of the dams and size of the cannon bone of 1,583 female offspring was studied. The averages show that dams from two to four years old give offspring with the heaviest cannon bone. However, the average cannon bone size of the offspring of dams from 14 to 16 years old was

practically the same as that of the offspring of dams in the classes five to seven and eight to ten years old.

The relation of the age of both parents to the size of the cannon bone of their offspring was studied. The average size of cannon bone was slightly greater in the female offspring of parents both of which were under ten years old than of those from parents either one or both of which were over ten years old. In studying how the measurements of the cannon bones of the female offspring deviate from those of their dams it was found that there was a significant variation only when both parents were ten years old and younger, and in this case the daughters were larger than the dams in cannon bone size.

The author suggests the following conclusions as a result of these studies: "The age of the parent has an influence on the circumference of the cannon bone of the offspring. Immature parents two to four years old give offspring with the same measurement of the cannon bone as parents as old as five to seven years. Parents older than ten years considered as a class give offspring with lighter cannon bones than parents ten years old and younger. In the breed examined there was found a larger percentage of individuals over average size whose parents were ten years old or younger. On the other hand, the average individuals and those smaller have parents which are just as frequently under ten years old as they are over. In other words, the lighter classes of cannon bone come as frequently from young as from old parents, but the heavier classes seem to come more frequently from younger parents. There seems to be some basis for the current opinion among breeders of Gudbrandsdal and other heavy breeds that young parents give better offspring than older parents."

The connection of these data with current genetic hypotheses and conceptions is discussed.

Mules that breed, O. Lloyd-Jones (*Jour. Heredity, 7 (1916), No. 11, pp. 494–502, figs. 7*).—The author comments briefly upon a number of recorded cases of fertility among mules and reviews physiological studies of the germ cells of these animals, which indicate that the chance of mule breeding is very slight.

The effect of the amino-acid content of the diet on the growth of chickens, T. B. Osborne, L. B. Mendel et al. (*Jour. Biol. Chem., 26 (1916), No. 2, pp. 293–300, pl. 1*).—Feeding experiments are reported in which two pairs of chickens (Rhode Island Reds) were fed, the one on a ration consisting of corn gluten, "protein-free" milk, starch, butter fat, and lard, and the other on the same ration plus lactalbumin. The mixed protein of the corn-gluten ration was considered to yield about 1 per cent of lysin, while the ration with the lactalbumin yielded a considerably larger quantity. During the course of the experiment one chick of each pair died from causes not ascertained.

The chick receiving the corn-gluten feed made a total gain in 55 days of 52 gm., while the chick receiving the corn gluten plus lactalbumin ration made a gain of 283 gm. in the same period.

It is indicated that the "observations corroborate, for the chick, the experience which we have previously published regarding the unlike value of different proteins in the nutrition of growth."

Further experiments are reported which demonstrate that cottonseed flour forms a suitable adjuvant for the proteins of corn gluten, as two chicks fed on such a ration made gains of 284 and 322 gm., respectively, in 53 days, as compared to a gain of only 52 gm. in 55 days by the chick fed the corn-gluten ration noted above.

It is indicated that in view of the work recently reported by Drummond (E. S. R., 35, p. 472), in which it was maintained that it is impossible to rear

to a satisfactory degree of development young chicks kept under the artificial conditions prevailing in the laboratory, further experience seems essential before a final conclusion in respect to the problem of the experimental feeding of young chicks can be promulgated. The rapid growth of this species, however, renders chicks especially suitable for experiments on growth.

See also a previous note by Buckner, Nollau, and Kastle (E. S. R., 34, p. 871).

Cottonseed meal—a good feed for laying hens, E. P. CLAYTON (*Mississippi Sta. Bul. 175 (1916), pp. 7, fig. 1*).—In continuation of work already noted (E. S. R., 30, p. 175) results are here given of feeding cottonseed meal to laying hens and to broilers.

In one test with old laying hens two lots of 9 hens each were fed a commercial scratch feed and a mash of corn meal, wheat bran, and oats. In addition, one of the lots was fed cottonseed meal to the extent of 11 per cent of the mash and the other lot beef scrap to the extent of 5.5 per cent of the mash. The cottonseed meal fed hens laid 249 eggs during the test, at a feed cost per dozen of 32.4 cts., and the beef scrap fed hens 174 eggs, at a cost of 40.8 cts. per dozen.

In another test with old White Leghorn hens two lots were fed a commercial scratch feed and a mash of corn meal and wheat bran. In addition, the 14 hens in lot 1 were fed cottonseed meal to the extent of 22 per cent of the mash and the 7 hens in lot 2 beef scrap to the extent of 11 per cent of the mash. One hen of lot 1 died at the beginning of the fourth month of the 6-months test. The hens in pen 1 laid 396 eggs, at a feed cost of 18 cts. per dozen, and and those in pen 2, 200 eggs, at a cost of 24 cts. per dozen. It is stated that the increased egg production of the cottonseed meal fed hens was especially noticeable during the fall molt.

Results are also given of feeding tests with broilers indicating that cottonseed meal, when it comprises 25 per cent or less of the mash, is a good feed for fattening broilers.

As a result of experience with the general flock the station recommends the feeding of cottonseed meal to poultry in amounts not exceeding 25 per cent of the rations. The author states that pullets at the station grow rapidly and mature and begin to lay early when fed a mash containing at first 15 per cent and later 25 per cent of cottonseed meal. Formulas are given for mashes and grain mixtures for laying hens and young chicks.

Rations for laying hens in winter, W. J. BUSS (*Mo. Bul. Ohio Sta., 1 (1916), No. 11, pp. 324, 325*).—Brief results are given of an experiment to determine the relative efficiency and economy of a ration of corn, wheat, and oats and one believed to be well balanced for egg production. Soy beans and meat scrap were also compared in this test as sources of protein for laying hens.

There were four lots of 21 Barred Plymouth Rock pullets each used in the experiment. Lot 1 was fed corn, wheat, and oats (3 : 2 : 1 by weight) ; lot 2, corn and wheat (3 : 1) and a mash of ground corn, bran, and meat scrap (2 : 1 : 2) ; lot 3, corn and wheat (3 :1) and a mash of ground corn, bran, ground soy beans, and meat scrap (4 : 4 : 5 : 5) ; and lot 4, corn, wheat, and soy beans (3 : 1 : 1) and a mash of ground corn, bran, and ground soy beans (2 : 1 : 2). All the lots received grit and all except lot 1 oyster shells. During the test which lasted from October 28, 1915, to March 15, 1916, the pullets in lot 1 produced an average of 3.08 eggs each at a feed cost per dozen of $1.55; lot 2, 32.21 eggs each at a feed cost of 21 cts. per dozen; lot 3, 22.95 eggs at a feed cost of 28 cts. per dozen; and lot 4, 7.37 eggs each at a feed cost of 76 cts. per dozen.

The logic of the winter feeding schedule, MR. and MRS. G. R. SHOUP (*Washington Sta., West. Wash. Sta. Mo. Bul., 4 (1916), No. 8, pp. 9–15*).—Continuing the experiment previously noted (E. S. R., 34, p. 669) results are reported which

show that from November 9, 1915, to January 3, 1916, the hens of lot 1 produced 1,267 eggs (22.4 per cent production) as compared to 3,017 (53.8 per cent production) produced by the hens of lot 2. Following slight modifications in the feed of lot 1 the egg production was markedly increased (41.9 per cent production), while following the use of artificial light early in the morning and late at night the production was raised to 60 per cent.

It is concluded that the increase in production was due chiefly to the use of the lights, while the protecting of the hens and the feed used are also deemed necessary for the maximum egg production.

The feeds used and the management of the flocks are briefly described.

DAIRY FARMING—DAIRYING.

Computation of dairy rations, F. S. Putney and H. P. Armsby (*Pennsylvania Sta. Bul. 143 (1916), pp. 3–24, fig. 1*).—On the basis of computations and tables outlined previously (E. S. R., 27, p. 176) and as noted on page 367, the authors discuss feeding standards, the art of feeding, the selection of feeding stuffs, the compounding of grain mixtures, the cost of rations, rations on pastures, and condimental and proprietary feeding stuffs. Convenience tables for computing grain mixtures, specimen grain mixtures, and tables showing the dry matter and digestible protein contents and net energy values of a large number of feeding stuffs are included.

Osage oranges for dairy cows, J. J. Hooper (*Breeder's Gaz., 70 (1916), No. 13, p. 537*).—In tests at the Kentucky Station cows were fed from 1 to 10 Osage oranges daily per head for periods of from two weeks to one month, in addition to grain, hay, and silage. The oranges were chopped fine and mixed with the grain. A few of the cows refused to eat the oranges, but others seemed to like them.

It is stated that the oranges can be kept for winter use by burying in a mound of earth.

The effect of feeding on the composition of milk and butter.—Dried yeast and decorticated cotton meal, H. T. Cranfield and Margaret G. D. Taylor (*Analyst, 41 (1916), No. 485, pp. 240–245, fig. 1*).—Experiments in which the feeding value of dried yeast and cotton-seed meal was compared with regard to milk production are described.

The results indicate that dried yeast is an excellent feed for dairy cows as regards the quality of milk and butter. The deficiency of fat in the ration does not appear to influence the quality of the milk or milk fat. A higher Polenské value in the fat from the animals that received the dried yeast was the only marked variation observed.

An increased yield of 41.25 lbs. of milk and 3 lbs. of milk fat were obtained in favor of the dried yeast during the four weeks of the experiment.

Variations in the composition of skim milk, A. E. Perkins (*Mo. Bul. Ohio Sta., 1 (1916), No. 10, pp. 304–306*).—A brief report is given of studies upon the variation in composition of skim milk derived from milk containing different amounts of fat. The variation in the fat content of skim milk is not discussed.

The ash content of skim milk varies with the fat and protein content, usually ranging from 0.65 to 0.85 per cent. It is stated that for practical purposes the protein and sugar content of skim milk may be computed from the analysis of whole milk by multiplying the protein and sugar contents of the whole milk by 1 plus the fat content of the whole milk. By this method and using analyses by other experiment stations of whole milk, the average per-

centage content of protein and sugar in skim milk from different breeds of cows was calculated as follows: Ayrshire, 3.46 and 5.2; Holstein, 3.25 and 4.8; Guernsey, 4.04 and 5.23; Jersey, 3.99 and 5.30; and Shorthorn, 3.44 and 5.07, respectively. On the basis of analyses of whole milk at the Ohio Station, the skim milk from three Holstein cows was calculated to contain 3.12 per cent protein and 5.06 per cent sugar, and from four Jersey cows 4.26 per cent protein and 5.18 per cent sugar.

To further test the relation of the fat content of whole milk and the composition of skim milk obtained therefrom, analyses of 807 samples of 10 groups of milk made at the Ohio and other stations are summarized. These groups ranged in fat content from an average of 2.19 per cent to 7.4 per cent. The percentage of protein in the skim milk was found to undergo a regular and progressive variation, being at its lowest point of 2.67 per cent in the extreme low-testing fat group and increasing regularly as the fat test increased, though not so rapidly. An increase of 5.21 per cent of fat between the average test of the first and last group was accompanied by an increase of only 2.38 per cent in the protein content of the skim milk. The sugar content in general varied with the protein content, but the variations were not so regular or marked. It was found that the fat content of mixed milk from several cows or of a composite sample of several milks from one cow does not often show much change without a corresponding variation in the skim milk solids.

The author concludes that "the fat content of milk as indicated offers a convenient and practical basis for computing with reasonable accuracy the composition of the skim milk derived from it."

The significance of the act of milking, C. CROWTHER (*Rpt. Brit. Assoc. Adv. Sci., 85* (*1915*), *pp. 779, 780*).—Data are reported in support of the hypothesis that in addition to the removing of preformed milk in the udder the operation of milking may impart a stimulus to further vigorous secretion during the period of milking.

Milking tests in which the "quarters" were milked separately and the milk from each quarter collected in fractions show that whereas in the case of the first quarter milked there is a tendency for the percentage of fat in the milk to rise steadily from the earliest drawn to the last drawn fractions, this tendency is much less pronounced in the case of the other quarters. In the quarter milked last the tendency for a considerable portion of the milking is for the percentage of fat to fall rather than to rise. In all cases there is a very rapid rise in the percentage of fat toward the close of milking.

Taking the produce of each quarter as a whole, in 34 out of 37 comparisons of first quarters milked singly, the first quarters gave richer milk than the last quarters. In 95 tests in which the quarters were milked in pairs the first pair milked gave the richer milk on 65 occasions. Very quick milking as compared with very slow milking showed a difference of 10 per cent in milk yield and 40 per cent in fat yield in favor of quick milking. A comparison of ordinary milking, taking the teats in pairs, and simultaneous milking by two milkers of all four quarters showed a difference of 2 per cent in milk yield and 6 per cent in fat yield in favor of the latter method.

Iowa educational market milk contest, B. W. HAMMER and A. J. HAUSER (*Iowa Sta. Circ. 30* (*1916*), *pp. 4*).—The results are given of two market milk contests that have been held by the dairy department of the Iowa College.

Safeguarding nature's most valuable food—milk, C. E. NORTH (*Vet. Jour. 72* (*1916*), *No. 496, pp. 329–339*).—This article, which was prepared for the New York Milk Committee, deals briefly with the food value of milk, the milk industry in the United States, clean milk, clarification, pasteurization, certified milk, selection of milk for home use, and municipal milk control.

The cost of milk production, J. Mackintosh (*Jour. Bd. Agr.* [*London*], *Sup. 16* (*1916*), *Sept., pp. 53–71*).—In this paper on the cost of milk production in England the attempt is made to evaluate the average cost of feed, various overhead and transit charges, interest on capital, and keep of the bull. In connection with feed costs credits have been given for manurial residues. The figures obtained relate to pre-war conditions. The investigations reported were carried on in only a few of the western counties of England, though brief references are given to other counties. The farms studied were divided as follows: Class 1, suburban farms; class 2, farms averaging 85 per cent grass land and 15 per cent arable land; class 3, farms averaging 66 per cent grass land and 34 per cent arable land; and class 4, farms chiefly arable lands. Only a few forms of the fourth type were studied, and the results obtained are not included in this paper.

The following table summarizes the averages obtained in 1914–15 on three of these type of farms:

Summary of cost of production per 100 lbs. of milk.

Type of farm.	Feed (gross cost).	Manurial residue.	Feed (net cost).	Overhead charges.	Transit charges.	Total cost.	Average yearly production per cow.
	Pence.	*Pence.*	*Pence.*	*Pence.*	*Pence.*	*Pence.*	*Gallons.*
Class 1	46.89	3.40	43.49	39.59	2.04	85.12	650
Class 2	36.11	2.52	33.59	24.45	14.37	72.41	640
Class 3	40.19	3.69	36.50	30.08	11.65	78.23	660

Some aspects of the dairying industry of England and Wales, W. Gavin (*Jour. Bd. Agr.* [*London*], *Sup. 16* (*1916*), *Sept., pp. 5–52, figs. 4*).—This paper deals with the development of the dairy industry of England and Wales in recent years; the share taken in the industry by different districts; the conditions obtaining in the different counties; the milk traffic of the various railway companies, with special reference to the London milk trade; the production and consumption of milk, both per capita and for the country as a whole; and the foreign trade in dairy produce.

The number of dairy cows and heifers in England and Wales increased from an average of 1,952,648 in 1881–1885 to 2,484,220 in 1914. Reckoning the average annual milk yield of cows in England at 582 gal. and in Wales at 425 gal. the estimated milk yield for 1915 is 1,070,000,000 gal. The annual consumption of milk per head of population is estimated at 15 gal. for London and 22.25 gal. for England and Wales. Statistics of London's milk trade are tabulated, and a review is given of the outstanding features of each of the principal producing areas.

The marketing of Wisconsin butter, B. H. Hibbard and A. Hobson (*Wisconsin Sta. Bul. 270* (*1916*), *pp. 69, figs. 21*).—A survey in cooperation with the Office of Markets and Rural Organization of the U. S. Department of Agriculture is reported.

In discussing the butter industry of Wisconsin it is pointed out that the making of butter on the farm in the State is decidedly on the decline, while the increase in creamery butter making for the past few decades has been phenomenal. Wisconsin has very few centralizers.

The formation, management, and operation of cooperative and independent or private creameries are discussed in detail. Data reported on the marketing of butter show that about 4 per cent of the annual production of the State

is sold to creamery patrons, 15 per cent is sold locally, and about 80 per cent is shipped. About two-thirds of the butter shipped from Wisconsin is marketed in Chicago, Philadelphia, New York, and Boston. The remainder goes direct to at least 10 other States. Of 136 creameries 106 sell on prices fixed by the Elgin board of trade, 25 on the Chicago basis, and 5 on the basis of New York prices.

The average shrinkage of 160 tubs in 5.77 days in 18 shipments of butter from Wisconsin to Chicago was 0.399 lb. per tub. The average loss to the creamery through market methods of weighing was 0.549 lb. per tub. The average loss due to shrinkage of 46 tubs of butter shipped from Wisconsin to New York was 0.418 lb. per tub. These shipments averaged 7.7 days from creamery to market and were held at the creamery an average of 49 hours. The effect of storage on the price of butter is discussed.

Of 258 farmers giving reasons for making dairy butter instead of patronizing the creamery 24.42 per cent reported that the former is more profitable, 37.2 per cent objected to the disadvantages in hauling milk, 5.04 per cent were dissatisfied with the creamery, 16.63 per cent on account of more and better by-products, 8.54 per cent had no milk market, and 8.17 per cent made butter for family use and sold the surplus. The average prices per pound received by farmers for dairy butter in 1914 were 30.8 cts. in winter, 27.7 cts. in spring, 25.5 cts. in summer, and 28.7 cts. in fall. One-half of the dairy butter is sold direct from producer to consumer and the remainder largely to grocers and retail merchants. Of 583,000 lbs. of dairy butter handled by about 400 merchants 104,000 lbs. were sold to wholesale butter houses and renovators, the remainder being sold at retail. The demand for farm-made butter is said to be weakening.

In order to ascertain the relation of quality to retail price 94 samples of butter were purchased from as many different retail merchants in Chicago, care being taken to select samples that would be representative of the quality of butter consumed in that city. Fifty-six of these samples were in the form of prints, including 24 brands, and 38 samples were in the bulk. The butter was scored by an expert butter judge. It ranged in quality from 82 to 92 points, with an average of 88.3, and in price from 28 to 40 cts. a pound. Although the quality of the bulk and print butter was the same the former sold at an average of 34.2 cts. and the latter 36.8 cts. a pound. It was found that there was no marked relationship between quality and price of these samples. Where the samples scored 85 or less the price was lower, but higher prices were charged for some butter scoring 86 than for that scoring 92. In order to test this relationship further, 117 Chicago retail stores were visited in April and May, 1915, and information as to quality, dealer's margin, and price to the consumer was secured for 271 samples of butter and 54 samples of oleomargarine. The retailers' margin and the prices to the consumer varied as much between lots of the same grade as between butter of the poorer and better grades. The average price of extra butter to the consumer was 0.9 ct. less than that of firsts and extra firsts, and that of extra firsts was 0.1 ct. less than that of firsts. The retailer's average price for seconds was 2 cts. less than firsts. The retailer's margin on oleomargarine was larger than on all the grades of butter. Approximately 75 per cent of the butter was in the form of cartoned prints.

Brief notes are given on how butter quotations are made by the Elgin board of trade and by the Chicago market.

At the time of this investigation butter was selling at an average retail price of 34.55 cts. a pound. Based on returns from cooperative creameries, the farmer was getting 23.33 cts. or 67.7 per cent of this amount, the remainder being distributed as follows: Cost of hauling the cream to the creamery and the

butter to the railway station 1.5 cts., cost of manufacturing butter, including container, 2.33 cts., railway transportation 0.8 ct., storage 0.18 ct., shrinkage 0.23 ct., wholesale agents, including receivers, jobbers, brokers, etc., 1.75 cts., packaging 1 ct., and retailer 3.43 cts. a pound.

Experiments on the preparation of homemade rennet, A. Todd and Elfrida C. V. Cornish (*Jour. Bd. Agr.* [*London*], *23* (*1916*), *No. 6, pp. 549–555*).—Experiments are reported on the home preparation of rennet from both fresh and dried stomach membranes of calves.

Rennet prepared from dried vells was of no practical value. Fresh vells of from 3 to 4 months-old calves and from young milk-fed calves produced an extract with fairly strong coagulating properties. With the addition of a preservative the rennet kept in good condition for six weeks and was then still active. The method of making the rennet is described. When used for cheese making in about double the quantity of commercial extract this rennet gave a very firm curd in a reasonable time.

The improved system of selling cheese, J. L. Sammis (*Hoard's Dairyman, 52* (*1916*), *No. 15, pp. 511, 512*).—Some of the faults of the "cheese board" system of selling cheese are pointed out, and a description is given of the Quebec system of inspection and classification of cheese before sale. The author states that by this system, which is used by the Quebec Cooperative Society, many of the objections to the cheese board have been overcome.

VETERINARY MEDICINE.

Outline of lectures in special pathology, S. H. Burnett (*Ithaca, N. Y.: Carpenter & Co., 1916, pp. 65*).—This guide consists of an outline of lectures given by the author at the New York State Veterinary College at Ithaca.

Annual reports of proceedings under the diseases of animals acts, the markets and fairs (weighing of cattle) acts, etc., for the years 1911, 1912, 1913, and 1914 (*Bd. Agr. and Fisheries* [*London*], [*Vet. Dept.*], *Ann. Rpts. Proc., 1911, pp. 119, pls. 2; 1912, pp. 117, pls. 2; 1913, pp. 110; 1914, pp. 102*).—These consist in the main part of reports of the assistant secretary of the animals division, A. W. Anstruther, with accounts of the occurrence of foot-and-mouth disease, hog cholera (swine fever), glanders, anthrax, sheep scab, parasitic mange, etc. The 1911 report also contains the report of the chief veterinary officer, S. Stockman. Plates showing the occurrence of hog cholera and sheep scab for 1909 to 1912, inclusive, are included.

Various statistical data on the occurrence of diseases, international trade in animals, etc., are presented in the appendixes.

Annual report for 1915 of the principal of the Royal Veterinary College, J. McFadyean (*Jour. Roy. Agr. Soc. England, 76* (*1915*), *pp. 286–298, figs. 6*).—This is the usual annual report dealing with the occurrence of and work with anthrax, glanders, sheep scab, swine fever, and foot-and-mouth disease. The different methods of testing with tuberculin are also considered at some length.

The Pharmacopœia of the United States of America (*Philadelphia: P. Blakiston's Son & Co., 1916, 9. ed., pp. LXXX+728*).—This ninth decennial revision, prepared by authority of the United States Pharmacopœial Convention, is official from September 1, 1916.

The National Formulary (*Philadelphia: Amer. Pharm. Assoc., 1916, 4. ed., pp. XL+394*).—This fourth edition, prepared by the Committee on National Formulary of the American Pharmaceutical Association, is official from September 1, 1916.

Magnesium hypochlorite in surgery, M. DUBARD (*Bul. Acad. Méd. [Paris], 76 (1916), No. 33, pp. 134–136; abs. in Jour. Amer. Med. Assoc., 67 (1916), No. 15, p. 1118*).—A 1 to 2.5 per cent solution of magnesium hypochlorite was found to be absolutely harmless, while its bactericidal power was considerable and its preparation simple and inexpensive. As a disinfectant for the wounded in the European War it has proved superior to any others, including Dakin's fluid.

The standardization of disinfectants.—A critical comparison of the Hygienic Laboratory and Rideal-Walker tests, J. T. A. WALKER (*N. Y. Med. Jour., 103 (1916), No. 11, pp. 500–505*).—From a general consideration of the various features of the two methods the author considers the Rideal-Walker method to be superior to the Hygienic Laboratory method in every respect.

A method of anaerobic plating permitting observation of growth, H. M. JONES (*Jour. Bact., 1 (1916), No. 3, pp. 339–341, fig. 1*).—The construction of a simple apparatus, which consists of one-half of a Petri dish sealed with paraffin on a square stone or metal base provided with an inlet for the inert gas and an outlet for the displaced gas, and its manipulation are described in detail.

A comparative study of colon bacilli isolated from horse, cow, and man, T. J. MURRAY (*Jour. Infect. Diseases, 19 (1916), No. 2, pp. 161–174, figs. 2*).—"On an average the different types of strains, human, bovine, and equine, exhibit a remarkable similarity in all reactions tested, chiefly in acid production. One remarkable exception was the ability of 24 strains of bovine colon bacilli to produce acid in inulin media. The other differences were not marked enough to be of value."

An experimental investigation into the rôle of the blood fluids in the intracellular digestion of certain bacteria and red blood corpuscles, S. R. DOUGLAS (*Proc. Roy. Soc. [London], Ser. B, 89 (1916), No. B 617, pp. 335–341*).—Experiments are reported in detail, the results of which show that the blood fluids have the property of influencing the digestion of such bodies as red corpuscles and bacteria taken up by the leucocytes. The action of the blood fluids is quite independent of the opsonic action, since the intracellular digestion may be more marked as the result of the action of a serum of low opsonic power than that of a serum of a much higher opsonic power.

"The power of the blood fluids to prepare such bodies as red blood cells or bacteria for digestion by solutions such as trypsin and leucoprotease, or by the digestive fluids which are secreted after such bodies are ingested by the leucocytes, is not . . . due to stimulation of or an action on the leucocytes, but is due to a direct action on the bacteria, or, as the case may be, the red blood corpuscles. This is demonstrated by experiments in which the red blood corpuscles or bacteria, after being brought in contact with fresh serum, which was subsequently removed, were found to be digested by solutions of trypsin or leucoprotease, solutions which had been previously shown to be quite without action." This property of the serum is destroyed by heating to 60° C. The name "protryptic" has been proposed for this property of the serum, as it appears to prepare such bodies as red corpuscles and bacteria for solution by the digestive fluids secreted by the leucocytes or by solutions of trypsin.

The permeability of the gastro-intestinal wall to infection with Sporothrix schenckii, D. J. DAVIS (*Jour. Infect. Diseases, 19 (1916), No. 5, pp. 688–693*).—The work reported indicates that white rats fed at intervals of a few days with large quantities of cultures of *S. schenckii* may become infected. The infection tends to localize in the mesentery, peritoneum, and spleen. The organisms also appear to penetrate the normal mucosa of the intestinal tract. No active or healed lesions were visible in the mucosa or in the wall of the stomach or intestines.

A laboratory infection caused by a bovine strain of Bacillus enteritidis, K. F. MEYER (*Jour. Infect. Diseases, 19* (*1916*), *No. 5, pp. 700–707*).—Clinical, bacteriological, and serological findings of a case of accidental infection by handling a bottle of sterilized milk which had been artificially contaminated with a culture of *B. enteritidis* is reported. It is indicated that "a recently isolated strain of *B. enteritidis* pathogenic for animals may differ from a strain pathogenic for man in its inability to be coagglutinated by paratyphoid or suipestifer sera."

The antibodies of spores, G. CHIMERA (*Clin. Vet.* [*Milan*], *Rass. Pol. Sanit. e Ig., 39* (*1916*), *No. 16, pp. 479–487*).—From the studies reported it is concluded that there is no evidence that specific agglutinins are liberated by the organism after inoculation of spores (*Bacillus anthracis, B. subtilis*), at least not within ten days after the inoculation. The agglutinins produced by the presence of bacilli have no action on the spores of the respective organisms.

The serological data are submitted in tabular form.

The precipitin reaction with silkworm caterpillar immune serum, K. AOKI (*Bul. Imp. Sericult. Expt. Sta. Japan, 1* (*1916*), *No. 1, pp. 53–81*).—The results of the investigation reported show that silkworm caterpillars can be easily differentiated from closely related insects by the precipitin reaction. The reaction can further be used to classify various closely and distantly related animal species so that they can be definitely placed in their proper zoological position.

The precipitin titer of the immune serum was found not to be equally high in all the sera of animals of the same species, especially if the serum came from an animal that was in the second, third, or fourth stage of development. In this case a lower precipitin value was given than would have been yielded by adult specimens or the pressed juice of the eggs. The silk glands of *Bombyx mori* show a strong organ specificity. No difference in the precipitant power of the sera of the two sexes of the silkworm caterpillars was observed. The data are presented in tabular form and discussed in some detail.

The application of the agglutinin reaction in the bacteriological examination of silkworms.—On the question of the identity of Bacillus sotto (Ishiwata), B. alvei (Chesire and Cheyne), and B. megaterium, K. AOKI and Y. CHIGASAKI (*Bul. Imp. Sericult. Expt. Sta. Japan, 1* (*1916*), *No. 1, pp. 83–95*).—Tabular serological data are reported which indicate that the agglutination reaction is strongly specific in the case of *B. sotto*. This organism can be easily differentiated from *B. megaterium* and *B. alvei* by this reaction, so that the question of its identity with the latter organisms can be discarded.

The biologic reactions of the vegetable proteins.—VIII, The specificity of the Abderhalden reaction with vegetable proteins, O. J. ELSESSER (*Jour. Infect. Diseases, 19* (*1916*), *No. 5, pp. 655–681*).—The work reported demonstrates that "the specificity of the Abderhalden reaction (dialysis method) in experimental animals (rabbits) immunized with pure isolated vegetable proteins is far from being absolute. . . . Under the conditions of the experiments the Abderhalden reaction is at best only quantitatively specific and even this quantitative specificity is not always exhibited. This is demonstrated by the following observations: (1) An homologous substrate may react specifically with its immune serum, no other protein reacting; (2) it may vary quantitatively in the degree of interreaction with its own immune serum; (3) it may react with its immune serum but no more strongly than do the heterologous substrates tried against the same immune serum; (4) it may give no reaction against its immune serum, while other heterologous proteins may react strongly against this serum; (5) it may react at times more strongly with a

heterologous immune serum than with its own immune serum. However, there is an obvious tendency for a substrate to react more often and yield stronger reactions when tested against its homologous immune serum than when tested against a heterologous immune serum."

In comparing the Abderhalden test and the anaphylactic test (E. S. R., 35, p. 679) with the pure vegetable proteins it was found that the results present certain resemblances and also some very definite differences. "In either reaction the more closely the proteins are allied chemically and physically the less specific the reactions tend to become. On the whole, however, the results obtained by anaphylaxis are much more constant and specific."

Experiments with the Abderhalden dialysis procedure, R. OTTO and G. BLUMENTHAL (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 24 (1915), No. 1, pp. 12–41, figs. 3*).—Detailed experimental data of the examination of the sera from pregnant individuals and from individuals afflicted with dementia præcox are reported.

The results show that sera from pregnant individuals almost invariably cleaved placental tissue. A positive reaction, however, is deemed only of limited diagnostic value, since other sera, especially those from carcinomatous individuals, give a positive reaction with ninhydrin after digestion with placental substrate. A negative reaction, however, may safely be taken to indicate the absence of pregnancy. The sera of dementia præcox patients (males) yield a positive reaction fairly regularly with testes, often with brain, and occasionally with placenta as substrate. Testes substrate is cleaved by the sera of patients suffering from other diseases, and also by the sera of pregnant individuals. The positive reaction with testes substrate is therefore also only of very limited diagnostic value, especially in differential diagnosis.

It is concluded that the dialysis procedure is not to be recommended for general practice because of the many sources of error in its manipulation. A bibliography of 28 references cited is included.

The complement content of Eck-fistula dogs, N. P. SHERWOOD, C. SMITH, and R. WEST (*Jour. Infect. Diseases, 19 (1916), No. 5, pp. 682–687, fig. 1*).—"The complement content of normal dog serum may vary in the same animal from $\frac{1}{4}$ to $\frac{1}{12}$ that of guinea pig serum. Immediately following the establishment of Eck's fistula there is a temporary drop in complement, lasting not more than 16 hours as a rule. There is a much greater drop in complement under chloroform anesthesia than under ether anesthesia. The return to normal is apparently just as rapid when only sufficient chloroform is used to produce the surgical anesthesia. The complement content of dog serum following the establishment of Eck's fistula was normal within from 6 to 16 hours after the operation and remained normal for at least 90 days (last observation) in the dogs studied.

"There is no corresponding drop in complement paralleling or accompanying the degeneration of the liver. There does not seem to be sufficient evidence, as yet, to warrant the assumption that the liver plays a more important rôle in the production of complement than do other organs or tissues of the body."

A cutaneous reaction in canine distemper, J. A. KOLMER, M. J. HARKINS, and J. REICHEL (*Jour. Immunol., 1 (1916), No. 5, pp. 501–510*).—The authors have prepared from a number of strains of *Bacillus bronchisepticus* (Ferry-McGowan) an antigen for use in anaphylactic tests for which the name "bronchisepticin" is proposed. Experimental data submitted indicate that the highest percentage of positive reactions occurred among animals having an acute case of the disease at the time the tests were made (77 per cent) and among those known to have had distemper while under observation (60 per

cent). In animals that presented no positive clinical evidences of the disease 35 per cent of the reactions were positive. The previous history of these animals, however, was unknown.

It is indicated that, while the "skin test may prove of practical value in the diagnosis of canine distemper and particularly as an index of a previous infection in an apparently normal animal, it is probable that it has no value as an index of immunity and that an animal presenting a positive reaction is still susceptible to relapses or recurrences of the disease."

Anaphylactic skin reactions in relation to immunity.—IV, The relation of the bronchisepticin skin reaction to immunity in canine distemper including the bactericidal action of dog serum for Bacillus bronchisepticus, J. A. Kolmer, T. Matsunami, and M. J. Harkins (*Jour. Immunol., 1 (1916), No. 5, pp. 571–584*).—Further anaphylactic skin tests indicate that a large percentage of dogs are hypersensitive to the protein of *B. bronchisepticus* and that the reactions are probably specific.

The sera of normal animals, those suffering with the disease, and those convalescent from the infection were found to possess very little or no bactericidal activity over the micro-organism as measured by tests in vitro. It is indicated that dogs yielding positive bronchisepticin reactions are still susceptible to canine distemper.

A contribution to the study of the changes in the blood count in dourine, N. Popesco (*Abs. in Jour. Amer. Vet. Med. Assoc., 48 (1916), No. 4, pp. 469, 470*).—A report of studies made while in search of a method of early diagnosis.

The virulence of the blood of animals affected with foot-and-mouth disease, G. Cosco and A. Aguzzi (*Policlin., Sez. Prat., 23 (1916), No. 18, pp. 551, 552; abs. in Jour. Amer. Med. Assoc., 66 (1916), No. 24, p. 1895*).—During the course of investigations made under the auspices of the National Public Health Service of Italy the blood of 116 cattle was found virulent during the entire febrile course of the disease, as virulent as the contents of the vesicles. The red corpuscles and the serum seem to be equally virulent and the defibrinated blood kept on ice retained its virulence for over a month. Erythrocytes thoroughly rinsed from all traces of serum, and the serum alone, reproduced the diseases on subcutaneous injection of other cattle with a dose as small as 1 cc. The authors consider the erythrocytes to be ideally adapted for the production of vaccine and are working along this line.

The K. H. reaction in glanders, J. Kranich and W. Kliem (*Ztschr. Veterinärk., 27 (1915), No. 10, pp. 289–296*).—A modified technique for the K. H. reaction of Pfeiler and Scheyer (E. S. R., 34, p. 276), which consists of complement deviation and hemagglutination, is described in detail. The system used is composed of horse serum as complement, bovine serum as amboceptor, guinea pig corpuscles as hemolytic antigen, the glanders bacillus, and the serum to be examined.

The procedure is deemed to yield excellent results and is highly recommended. The name hemagglutination reaction is proposed in place of K. H. reaction.

Johne's disease, J. M'Fadyean and A. L. Sheather (*Jour. Compar. Path. and Ther., 29 (1916), No. 1, pp. 62–94*).—Reports are given upon the experimental transmission of the disease to cattle, sheep, and goats, with notes regarding the occurrence of natural cases in sheep and goats. The facts here recorded suggest that among sheep the disease may have a wider distribution than has heretofore been suspected.

Milk in relation to Mediterranean fever, C. Porcher and P. Godard (*Le Lait et la Fièvre Méditerranéenne. Paris: Asselin & Houzeau, 1916, pp. 114, pls. 4, figs. 3*).—This is a contribution to the study of the rôle which milk plays

in the etiology and spread of Mediterranean or Malta fever, including a review of the literature pertaining to this disease. The subject is treated under the following headings: The history and dispersion of Malta fever; the appearance, culture, and vitality of *Micrococcus melitensis;* symptoms, diagnosis, and prophylaxis of Malta fever; the infection of goats with *M. melitensis;* the relation of goat's milk and cheese to Malta fever in man; and the detection of unhygienic milk by chemical analysis.

It is concluded that Malta fever is transmitted to man almost wholly by drinking raw milk from infected goats or by eating curd or cheese made from goat's milk. In infested districts goat's milk should not be used unless it has been boiled and cheese from goat's milk should not be eaten unless it is very old.

Hereditary transmission of rabies, D. Konradi (*Ann. Inst. Pasteur, 30 (1916), No. 1, pp. 33–48; abs. in Amer. Jour. Vet. Med., 11 (1916), No. 10, pp. 808, 809*).—The author concludes in this paper, continuing previous work (E. S. R., 20, p. 279), that with dogs, rabbits, guinea pigs, and probably other animals the rabies virus is transmitted from mother to fetus, but its virulence gradually diminishes. See also other notes (E. S. R., 22, pp. 587, 682).

A modification of the Hygienic Laboratory method for the production of tetanus toxin, Harriet L. Wilcox (*Jour. Bact., 1 (1916), No. 3, pp. 333–338*).—A method essentially the same as that used at the Hygienic Laboratory of the U. S. Public Health Service,[1] with a few slight variations, is described in detail.

A new culture medium for the tubercle bacillus, W. W. Williams and W. Burdick (*Jour. Bact., 1 (1916), No. 4, pp. 411–414*).—The preparation of an egg-meat infusion culture medium containing gentian violet as an inhibitor of the growth of contaminating micro-organisms is described in detail. A method of isolating tubercle bacilli from sputum is also described.

The combined and follow-up systems of tuberculin testing, G. H. Hart and J. Traum (*Jour. Amer. Vet. Med. Assoc., 50 (1916), No. 2, pp. 189–214*).—This is a general discussion of the subject, together with some experimental data from which it is concluded that tuberculous animals, while giving negative results to one form of tuberculin application, may give positive reactions to another form. The value of combining two or more tests and following with further tests several weeks later on all nonreacting animals is deemed evident. The value of the follow-up test is to detect animals in the incubation stage or those which were insensitive to tuberculin for other reasons at the time of the previous test. The ophthalmic test, together with an intradermal injection, is considered to be a very satisfactory combination.

Studies in infectious abortion in cattle, W. Giltner, E. T. Hallman, and L. H. Cooledge (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 3, pp. 320–339*).—This article contains tabulated serological data obtained in a comparison of the complement fixation with the agglutination test for contagious abortion, together with temperature charts of nonpregnant animals which had received two injections of living organisms and of pregnant animals receiving injections of dead organisms.

From comparative data it appears that the complement fixation test will indicate more reactors than the agglutination test. However, animals were found to react to the agglutination test and not to the complement fixation test.

The material by Cooledge previously noted (E. S. R., 34, p. 679) is also included.

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[1] Jour. Med. Research, 33 (1915), No. 2, pp. 239–241.

A case of contagious broncho-pneumonia caused by Bacillus coli communis, E. M. Stanton (*Vet. Jour., 72 (1916), No. 490, pp. 138, 139*).—In an outbreak of this disease in Massachusetts in which some 40 young calves succumbed *B. coli communis* appeared to be the causative agent.

The use of arrhenal for the treatment of Texas fever, J. E. Aghion (*Jour. Amer. Vet. Med. Assoc., 50 (1916), No. 2, pp. 227, 228*).—The successful use of arrhenal (disodium-methyl arsenate) in several cases of Texas fever in cattle in Egypt is reported.

Further studies on hog cholera with reference to Spirochæta hyos, W. E. King and R. H. Drake (*Jour. Amer. Vet. Med. Assoc., 50 (1916), No. 2, pp. 168–188, figs. 6*).—Inoculation experiments with several strains of virus are reported and the results discussed in some detail.

It is concluded in general that in order to prove with certainty the direct etiological relation of *S. hyos* to hog cholera "some means must be developed through which the organism may be isolated in pure culture directly from the infected animal in order that pure cultures, unattenuated by tedious manipulation in an artificial environment, may be utilized in a series of animal inoculation experiments. Under such conditions uniformly positive results, together with data already in hand, would serve as final, conclusive evidence as to the specific pathogenicity of *S. hyos*."

It is indicated that until such experiments can be successfully carried out positive conclusions must be withheld. *S. hyos*, however, is regarded as an organism present in animals infected with hog cholera, possessing certain characteristics suggestive of its pathogenic nature.

Illinois hog cholera serum plant (*Breeder's Gaz., 70 (1916), No. 20, pp. 929, 930, figs. 4*).—This is a description of the equipment and methods employed in the manufacture of serum at the Illinois state hog cholera serum plant at Springfield.

Enterohepatitis or blackhead in turkeys, C. H. Higgins (*Canada Dept. Agr., Health Anim. Branch Bul. 17 (1915), pp. 11, pls. 5*).—A general account of this disease, together with an account of the prevention of blackhead by the biological laboratory method of artificial incubation and isolation.

Enterohepatitis or blackhead and the biological laboratory system of raising turkeys, C. H. Higgins (*Canada Dept. Agr., Health Anim. Branch Bul. 19 (1916), pp. 6*).—The information given in this bulletin supplements that noted above and outlines the biological laboratory system of raising turkeys.

RURAL ENGINEERING.

Proceedings of the Ohio Engineering Society, thirty-seventh annual meeting held February 9, 10, 11, 1916 (*Proc. Ohio Engin. Soc., 37 (1916), pp. 189, figs. 5*).—These proceedings contain among others the following special articles: Road Legislation, by C. C. Cass; The Need of Drainage Legislation, by C. L. Bushey; The Monolithic Construction of Brick Pavements, by M. B. Greenough; The Concrete Roads of Lake County, by H. P. Cumings; Construction of Bituminous Macadam Roads by the Penetration Method, by H. B. Stone; and Paints for the Protection of Steel Bridges, by J. H. Vance.

Laws of the State of Idaho relative to public waters, water rights, and irrigation, compiled by A. C. Hindman (*Boise, Idaho: Idaho Irrig. and Drainage Code Com., 1915, pp. 303*).—The text of the laws is given.

Run-off and mean flow of some Texas streams, T. U. Taylor (*Bul. Univ. Tex., No. 65 (1915), pp. 25, figs. 10*).—Measurements of flow made since 1896 on the Colorado River at Austin and Columbus, Tex., on the Brazos River at

Waco, Tex., and on the Trinity River at Dallas and Riverside, Tex., are reported in tabular and graphic form.

Warner Valley and White River Projects, J. T. Whistler and J. H. Lewis (*Oreg. Cooper. Work. Dept. Int. U. S. Reclam. Serv., 1916, Feb., pp. 123, pls. 4, fig. 1*).—This report was prepared in cooperation with the State of Oregon.

The development proposed by the Warner Valley Project is the drainage of 46,000 acres of swamp land in Warner Valley, the irrigation of 33,000 acres of these lands in the south end by gravity canals, and pumping to irrigate 27,000 acres in the north end. Among the features specially referred to are the development of 2,000 electrical horsepower on Deep Creek for operating dredges during construction and to furnish power to four pumping plants in North Warner Valley on the completion of the project, and the provision for ample storage in Big Valley and Coleman Valley to insure the reclamation of the marsh lands in years of extreme run-off. The probable cost of this development as outlined is estimated at $1,726,000, or about $29 per acre. From the records of discharge for the streams entering Warner Valley for six years it is estimated that the mean annual run-off to the valley is 195,000 acre-feet, with a maximum of 308,000 acre-feet in the seasonal year 1910 and a minimum of 84,000 acre-feet in the seasonal year 1915. The extreme maximum run-off, it is stated, may reach nearly 600,000 acre-feet.

The White River Project is located to the south and east of the Oregon National Forest, in the vicinity of Mount Hood. "The drainage basin has an area of about 350 square miles and is largely forested in the upper regions of White River and tributary streams. . . . The mean annual run-off of White River near Tygh Valley for four years is about 234,000 acre-feet, the maximum occurring in the seasonal year 1911–12 with 297,000 and a minimum in 1914–15 with 163,000 acre-feet. . . .

"The soil, while shallow in places, is of fairly good quality and well adapted to irrigation. The percentage of waste land in the gross irrigable area is rather large, however, and the distributing system will, on this account, be more expensive. Drainage, which in some localities may be necessary, will not be difficult, as the topography of the region lends itself to an inexpensive system. . . . With an assumed duty of 1.5 acre-feet delivered to the land during the irrigation season, the plan of development includes (1) a storage reservoir in Clear Lake with a capacity of 18,000 acre-feet, furnishing 12,000 acre-feet net storage supply; (2) a diversion dam at the mouth of Boulder Creek; (3) two diversion canals, the one on the north being eight miles long with a capacity of 130 second-feet, to water approximately 13,000 acres, and the one on the south side of White River being ten miles long with a capacity of 230 second-feet, to water approximately 23,000 acres; (4) a distributing system for about 36,000 acres net.

"The apparent cost of this proposed development of 36,000 acres is $36 per acre irrigated, including the purchase of the White River power plant."

The saving of irrigation water in wheat growing, A. and Gabrielle L. C. Howard (*Fruit Expt. Sta. Quetta Bul. 4 (1915), pp. 14*).—This bulletin describes the soil, rainfall, temperature, and humidity of the Quetta Valley of India, describes the present methods of growing wheat, enumerates the principles underlying economy in the use of water in wheat growing, and reports experiments on water saving in wheat growing at Quetta.

The soil of the valley varies from brown to black in color and is of loessial origin. Flooding destroys its porosity and the surface is easily compacted. Wheat was grown on natural moisture only and with a single irrigation. Mulching was practiced as a water conservation measure in the first case and

only a thin crop was obtained, as much moisture was lost when it became impossible to continue the mulch. In the second case the land received one surface flooding after which it was cultivated by a spring tooth cultivator and leveled. The land was then sowed and a mulch maintained. The average yield of wheat was somewhat greater than the average yielded by simlar unmanured land with six or seven irrigations.

"It is clear that as far as irrigated wheat growing is concerned, there is an enormous loss of water which might be profitably employed. The skillful use of the lever harrow after rain would also increase the yield of the unirrigated or dry crop wheat. Examined scientifically, the methods now in vogue are wasteful in the extreme both as regards the irrigation water and the winter rain and snow. To improve practice, two new implements are necessary—the spring-tine cultivator and a pair of lever harrows. . . . At a small cost, a very material increase in wheat production is possible in the Quetta Valley."

[Road laws] (*Montgomery, Ala.: State, 1916, pp. 16*).—This is a circular from the State Highway Department of Alabama to courts of county commissioners and boards of revenue of the counties of Alabama suggesting laws, rules, and regulations governing the working, maintenance, and preservation of the public roads.

Second report of the state engineer [of Arizona] to the state highway commission, L. Cobb (*Rpt. State Engin. Ariz., 2 (1915–1916), pp. 673, pls. 3, figs. 118*).—This is a report of the work and expenditures of the state engineer's office on road and highway construction, maintenance, and repair in Arizona for the fiscal years 1915 and 1916.

The financial side of road improvement, B. K. Coghlan (*Bul. Agr. and Mech. Col. Tex., 3. ser., 2 (1916), No. 8, pp. 22, figs. 6; rev. in Good Roads, 50 (1916), No 19, p. 202*).—The author deals with the oconomics of road improvement, with special reference to conditions in Texas.

Demonstration roads at the Agricultural and Mechanical College of Texas, R. L. Morrison (*Bul. Agr. and Mech. Col. Tex., 3. ser., 2 (1916), No. 1, pp. 20, figs. 15*).—Brief descriptions and specifications for sample roads, used as a part of the course of instruction in highway engineering at the Texas College, are given.

Earth roads, R. L. Morrison (*Bul. Agr. and Mech. Col. Tex., 3. ser., 1 (1915), No. 2, pp. 20, figs. 14*).—This bulletin describes and illustrates the processes and machinery used in improving earth roads.

Gravel roads, B. K. Coghlan (*Bul. Agr. and Mech. Col. Tex., 3. ser., 1 (1915), No. 8, pp. 16, pls. 4, figs. 4*).—This bulletin deals with the location, construction, and maintenance of gravel roads, with special reference to conditions in Texas.

Highway bridges and culverts, B. K. Coghlan (*Bul. Agr. and Mech. Col. Tex., 3. ser., 1 (1915), No. 5, pp. 30, figs. 12*).—This bulletin deals with the important features of proper inspection, repairs, replacement, and maintenance of highway bridges and culverts and with the inspection of traffic as related to these.

Convict labor for road work, J. E. Pennybacker, H. S. Fairbank, and W. F. Draper (*U. S. Dept. Agr. Bul. 414 (1916), pp. 218, pls. 14, figs. 10*).—This report, prepared in cooperation with the U. S. Public Health Service, deals with "as nearly as possible all questions that might arise in connection with either the adoption of a policy relating to the use of convict labor in road work or the actual working out of such a policy. To this end a presentation and discussion of the principles involved, a digest of convict road laws, and a discussion of every phase of operation are embodied in the bulletin, together with specific detailed instructions for the carrying out of all recommendations."

Six systems of convict labor are described as "the lease, the contract, the piece-price, the public-account, the state-use, and the public-works-and-ways systems." The report embodies data obtained from personal visits made to convict camps and conferences held with state highway and prison officials in the States of New York, New Jersey, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Alabama. Florida, Mississippi, Louisiana, Texas, Michigan, Colorado, New Mexico, Arizona. Utah, Wyoming, California, Washington, and Oregon.

A special section is included on the character, preparation, and cost of food from data prepared by the Office of Home Economics of the States Relations Service. Other special sections on water supplies and camp sanitation are included, much of the substance of which has been noted in previous reports by Trullinger (E. S. R., 30, p. 690), Freeman (E. S. R., 34, p. 83), Lumsden, Stiles, and Freeman (E. S. R., 34, p. 88), and Cook, Hutchison, and Scales (E. S. R., 33, p. 455).

Experimental studies of vacuum juice heaters, E. W. KERR and S. J. WEBRE (*Louisiana Stas. Bul. 159 (1916), pp. 46, figs. 20*).—Experiments on the operation of vacuum juice heaters, including the effect of air in steam, juice velocity, absolute pressure of the heating steam, tube materials, and the length of vapor path upon heat transmission, are reported. The experiments were made upon three different outfits, namely: (1) An especially designed small juice heater connected with a single effect evaporator in the engineering laboratory, (2) vacuum juice heaters connected to each body of the double effect at the Audobon Park sugar factory, and (3) the vapor juice heaters in connection with the quadruple effect at the Central Florida in Cuba. The first outfit was used strictly for research work, while the other two represented operation under regular factory conditions.

The laboratory experiments showed the marked effect of the presence of air in steam in reducing the coefficient of heat transmission. "This shows the necessity of properly venting vacuum juice heaters." The juice velocity was varied from a minimum of 131 ft. per minute to a maximum of 502 ft. per minute with corresponding variations in the coefficient of heat transmission of from 412 to 588. Tests made to compare the coefficients of heat transmission of copper and seamless cold-drawn steel tubes with vacuums of 0.0, 6, 13, and 18 in. and constant juice velocities gave average coefficients for copper and steel tubes of 576 and 280, respectively. The greater the vacuum the lower was the coefficient of heat transmission.

In the experiments with the second outfit, the effect of air richness in the heating vapor in decreasing the coefficient of heat transmission was shown. "It was found to be impossible to control the removal of air through the vents satisfactorily." Comparative studies of the effect of the use of juice and of water on heat transmission showed that the coefficients obtained with juice were considerably lower than those obtained with water. "The experiments brought out very clearly the importance of thorough venting of air and drainage of condensation. The difficulties encountered in relation to these two points emphasize the advantages, especially as regards the capacity, of taking the heating vapors from other than the last body of a multiple effect, even though the last body has the advantage in the matter of economy."

Tests on the general performance of the vacuum heaters in the third plant and on the effect of air in vapor showed that when provision was made for venting air the coefficients of heat transmission were much greater. Tests on the relation between air in steam and length of steam travel showed little increase in air richness for the first 15 ft., but thereafter the increase was

marked. Tests on the relation of juice temperature to juice travel showed that the temperature rise with distance of travel decreased in each successive heater. The curves of sharpest curvature corresponded to those with the highest coefficient and lowest air content and vice versa.

Tests of the power and steam consumption of sugar factories, E. W. Kerr, W. A. Rolston, and S. J. Webre (*Louisiana Stas. Bul. 158 (1916), pp. 45, pl. 1, figs. 6*).—Tests of the power and steam consumption of three sugar factories of 1,500, 4,500, and 1,000 tons daily cane handling capacity are reported. The power systems of the factories consisted, respectively, of centrifugal pumps, belt, and shafting; part electric motor and part direct steam drive; and all electric motor drive. The evaporating systems of the first two were plain quadruple effect and of the third quadruple effect and vapor juice heater.

The power consumptions per ton of cane per 24 hours were 0.65, 0.873, and 0.98 horsepower, respectively. The ratio of exhaust steam to total steam in the first plant was 0.4 and in the last 0.67. Considerable other data of tests are reported in tabular and graphic form.

Some experiments on pulling loads, with a discussion of the results, B. H. Brown (*[Walla Walla, Wash.: Author], 1916, pp. 16, figs. 6*).—This pamphlet reports several experiments "which have been made for the special purpose of measuring the pull in pounds exerted by horses as they move loads on the road and in the field."

In the hauling tests the roads selected were a macadam with a 0.4 per cent grade, a pavement with a 0.4 per cent grade, valley dirt with a 1.4 per cent grade, dirt wash from a hillside with a 3.1 per cent grade, a side of a hill with a 9.25 per cent grade, a brow of a hill with a 4.68 per cent grade, and a highland country road with a 1.44 per cent grade. Two wagons were used, the first having all four wheels of 3 ft. 6 in. diameter and a tire width of 3.25 in., and weighing, with two men, 1,950 lbs.; the second being a narrow-tire wagon, weighing, with two men, 1,705 lbs., with front wheels 3 ft. 9.5 in. in diameter, and hind wheels 4 ft. 7 in. in diameter. Both wagons were drawn empty and with loads of 2,020 and 4,040 lbs. both ways over the road on the same day.

It was found that the average force required to pull the wagons on the section of pavement was much less than that required for the macadam section. The average pull upgrade and downgrade on the pavement for a load of 4,040 lbs. on the narrow-tire wagon was less than 160 lbs. It required on the average a force of 70 lbs. to pull the empty wagon on the level pavement and 158 lbs. to pull the same wagon when loaded with a weight of 4,040 lbs. This means that for each additional ton of load an extra pull of 44 lbs. was enough to move the load on the pavement. "The pull up the 9.25 per cent grade, on the hillside dirt, was for the same load and wagon, 886 lbs. It required a force of 264 lbs. to pull the empty wagon up this grade. Taking this amount from the 886 lbs. for wagon and load leaves 622 lbs. as the extra pull required for the 2 tons of load, or an excess of 311 lbs. per ton up the grade. This is more than seven times as much per ton as that required on the pavement."

A comparison of the pull in the valley and on the highland showed "an unmistakable balance in favor of the highland road in the case of the wide-tire wagon, while with the narrow-tire wagon there was no great difference between them." An estimate of the horsepower used showed "that in every section except pavement the horses did more work per minute than the standard amount adopted for the horsepower. . . .

"The tests showed that the heavy horses used in the tests were fully able to do the work generally accepted as a full horsepower for each horse. For a horse weighing only 1,000 lbs. the standard horsepower of 33,000 foot-pounds per minute would be too high, especially in the case of tandem teams or a

group of 30 or more horses drawing a combine. . . . Throughout the tests it was found that a 1,000-lb. pull for the two-horse team was a severe strain and could be sustained for only a few seconds at a time."

Tests made to measure the force required to pull the wagons over newly plowed ground and over tall wheat stubble gave the following results:

Draft tests on plowed ground and stubble.

Type of wagon.	How drawn.	Wagon empty.	1-ton load.	2-ton load.
		Pounds.	*Pounds.*	*Pounds.*
On plowed ground:				
Narrow-tire wagon	Straight ahead	284	808	1,300
Do	In a curve	444	910	1,612
Wide-tire wagon	Straight ahead	432	994	1,342
Do	In a curve	534	1,038	1,562
On stubble field:				
Narrow-tire wagon	Straight ahead		516	872
Do	In a curve	198	572	1,122
Wide-tire wagon	Straight ahead	264	520	1,018
Do	In a curve	310	608	1,216

"Some tests were made by starting loads in different ways to find the force required to start loads in ordinary practice. Out of 38 starts with the narrow tire wagon, empty and loaded, the average starting force was 2.6 times the average pull required to keep the wagon in motion after it had been started. The average for the wide-tire wagon, under the same conditions, was 2.9. . . .

"Some experiments were made to find out what could be done to lessen the extra pull at the time of starting loads. Out of many trials, the force required to start the wide-tire wagon slowly was found to be only 61 per cent of that required for the ordinary start in which the reins were gathered up and the load was supposed to move without delay. The force for an easy start, in the case of the narrow-tire wagon, was only 58 per cent of that required for the ordinary start. . . . The advantage of the slow start was fully demonstrated.

"The plan of starting a load with a pull sidewise is fairly effective on hard ground as it enables the team to get into motion slowly. In soft ground, however, when the front wheels are cramped to one side so that the hind wheels do not follow in their tracks, there is great disadvantage in breaking out the new wheel tracks."

The average results of tests of plow draft are given in the following table:

Draft of plows.

Kind of land.	Kind of plow.	Depth.	Number of horses.	Pull.
		Inches.		*Pounds.*
Hill	Two 14-in. gang	7	6	775
Field	One 14-in. walking	8	3	345
Bottom	One 12-in. walking	8	2	540
Bench	One 14-in. wheel	8	8	1,154
Field	One 16-in. wheel	11	6	750

"The pulls in pounds given in the table are averages of as many as 80 readings in some cases."

Second series of tests of mechanical cultivation, E. Marre (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 37 (1916), No. 20, pp. 464–468*).—Plowing tests on red clay soil and productive residual soil of a tractor having a 2 cylinder, 12–24

horsepower motor running at 400 to 750 revolutions per minute are reported. The grade of the red clay soil varied from nearly level to from 25 to 30 per cent.

The tractor was unable to pull a 3-bottom gang plow uphill effectively but pulled a 2-bottom plow both ways. The 3-bottom plow, covering a width of 1.05 meters (3.44 feet), was pulled downhill. In the residual soil with easy slope the tractor drew a double-bottom plow at a depth of 27 cm. (10.5 in.) and covered a width of 33 cm. Six oxen plowed the same width but only 25 cm. deep. The tractor plowed 1,056 square meters (0.26 acre) per hour and hauled a 16-toothed scarifier and a 3-piece harrow. It traveled twice as fast as oxen and it is considered to have replaced eight pairs of oxen and six men in the amount of work done.

Twenty-three liters (6 gal.) of petrol were burned in the engine in 2¾ hours, of which 1¾ hours were consumed in actual work and the other hour in stops and travel.

Plans and suggestions for the arrangement and construction of a modern milk house (*[New York], Borden's Condensed Milk Co., 1916, pp. 32, figs. 33*).—Plans and descriptions of milk houses and ice houses for dairy farms are given.

Inexpensive plumbing for farm kitchens, W. A. ETHERTON (*Kans. Agr. Col. Ext. Bul. 9 (1916), pp. 23, figs. 7*).—This bulletin describes plumbing systems for farm kitchens based on the method of using a force pump and three-way cocks described in a previous article (E. S. R., 35, p. 496).

The operation of a simple system of the type is described, showing how cold and hot water may be pumped and water siphoned from the hot water boiler to the sink or back to the cistern. A combination system using an attic tank or a pressure tank with this system is also described, together with fittings for shower baths, etc. A third section itemizes and explains the parts of the apparatus. A final section on cost, based on conditions in Kansas in April, 1916, is included.

The water supply of the farmhouse, J. D. WALTERS (*Kans. Agr. Col. Ext. Bul. 10 (1916), pp. 42, figs. 15*).—This is a semipopular bulletin, based on Kansas conditions, containing sections on the following subjects related to farm water supplies: Amount of water required; spring water and well water; wells; contamination of wells; artesian wells; filtering the cistern water; pumps, lifts, and rams; power required to lift water; theoretical horsepower; the windmill; the water tank; the concrete reservoir; the water tower; the air-pressure tank; compressed air lifts; soft water for the laundry and the bathroom; the automatic water lift; the hydraulic ram; the friction element in plumbing; and cheap home ice.

Water supply systems for the farm home, H. W. RILEY (*Cornell Countryman, 13 (1916), Nos. 7, pp. 566–569, figs. 3; 8, pp. 665–668, 690, 692, figs. 4*).—A brief description of hydropneumatic and pneumatic tank water supplies is given, together with a discussion of the hydraulic principles involved in pumping and distributing water for small systems.

Sewage treatment in small communities without sewerage systems, P. HANSEN (*Univ. Ill. Bul., 13 (1916), No. 19, pp. 189–195, figs. 5*).—Small sewage purification systems, consisting of settling tank and tile absorption areas of sufficient size to meet temporarily the requirements of small communities, are briefly described and illustrated.

RURAL ECONOMICS.

Agricultural economics, E. G. NOURSE (*Chicago: Univ. Chicago Press, 1916, pp. XXV+896, figs. 23*).—"This volume represents an effort to carry over into agricultural economics some results of recent experience in the use of the dis-

cussion methods of teaching elementary and intermediate courses in economics. The book aims to bring together in an orderly arrangement (1) a store of information which may profitably come within the view of the student who desires to understand the economic phenomena of agriculture, and (2) a considerable number of opinions which have already been expressed as to the meaning of these facts."

The author has divided the contents into the following chapters: The emergence of the problem of agricultural economics; consumption; land and other natural agents of agricultural production; human effort as a factor in agricultural production; capital-goods as a factor in agricultural production; organization and management of the agricultural enterprise; records and accounts as measures of efficient management; principles of value and price as related to farm products; market methods and problems; transportation and storage facilities as factors in the marketing of farm products; the rent and value of farm land; land tenure and land policy; interest on farm loans; rural credits; agricultural wages; some problems of agricultural labor; and profits in agriculture.

The relationship of New England agriculture to manufacturing, K. L. BUTTERFIELD (*Trans. Nat. Assoc. Cotton Manfrs., No. 100* (*1916*), *pp. 213–223*).—The author calls attention to the fact that agricultural products are in many instances the basic products in manufacturing industries and discusses the extent to which the farmers in New England can furnish such material. He also calls attention to the available products as they might influence the diet of the working men and their families and indirectly influence the efficiency of New England manufacturing industries.

Farm management studies in eastern Nebraska, H. C. FILLEY (*Nebraska Sta. Bul. 157* (*1916*), *pp. 32, figs. 5*).—The author's conclusions are as follows:

"The 80-acre grain and stock farm of eastern Nebraska does not utilize man, horse, or machine labor as efficiently as do farms of a larger size. The family farm which provides work for approximately two men or the equivalent, seems to be the most profitable. On the farms surveyed, approximately half of the work, aside from that done by the operator, was performed by boys under 21.

"The best paying farms found in this survey had crop yields from 15 to 30 per cent better than the average of all farms, while of the farms whose yields were as much as 15 per cent below the average of their community, few gave satisfactory returns. The most profitable farms included in this survey sold two or three major products and from two to four minor products. Those selling but one or two products were not profitable as they did not furnish productive labor for a large enough part of the year.

"If 5 per cent interest is allowed upon all capital invested by the operator, owned farms returned an average labor income of \$203 and tenant farms an average of \$806 to the operator. The better showing made by the tenant farms is largely accounted for by the fact that they returned to the landlord only 3.5 per cent interest upon the land valuation, while the owner-operator is charged 5 per cent upon his valuation. The low rate of return is due primarily to the security of the investment. Owned farms in Richardson county contributed \$509, and tenant farms \$405 toward the farmers' living, in addition to the 'labor income.' This is somewhat above the average of farms covered by the survey.

"Placed upon the same basis as the city wage earner, with interest upon land figured at the landlord's rate of return, the average farmer of eastern Nebraska receives between \$1,000 and \$1,200 per year for his labor and management."

Rural land ownership among the negroes of Virginia, S. T. Bitting (*Charlottesville, Va.: Univ. Va., 1915, pp. 110, fig. 1*).—The author discusses the factors which influence the negroes in obtaining possession of the land and their success in developing the right types of farming. The discussion relates to conditions in Virginia in general, with special emphasis upon conditions found in Albemarle County.

Facts about land (*London: John Murray, 1916, pp. XVI+319*).—This report, prepared by the Land Agents' Society, discusses and criticizes the report of the Land Enquiry Committee (E. S. R., 30, p. 491).

Farm work for discharged soldiers, H. E. Moore (*London: P. S. King & Son, Ltd., 1916, pp. 31*).—This publication contains proposals indicating the manner in which disabled or discharged soldiers may be assisted to secure a livelihood from agricultural work and suggests a method by which the State could aid that object.

Rural cooperation in Denmark, G. Desbons (*La Coopération Rurale en Danemark. Montpellier: Fermin & Montane, 1916, pp. 178*).—The author discusses the development of cooperation in Denmark, the organization and functions of agricultural associations, the difficulties met, and the results accomplished.

The result of an experiment in agricultural credit in Tuscany, F. Virgilii (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 12 (1915), No. 3–4, pp. 229–237*).—These pages contain a brief discussion of the results obtained in an agricultural bank established in 1913 in Tuscany.

The report of the Agricultural Organization Society for the year ended March 31, 1916 (*Rpt. Agr. Organ. Soc. [London], 1916, pp. VIII+99*).—This report contains brief statements regarding the various activities of the society, with special reference to war conditions.

[Report on the working of the cooperative credit societies], G. Nath (*Rpt. Coop. Credit Socs. Ajmer-Merwara, 1916, pp. 15+[21]*).—This report sets forth the progress of the work in connection with the societies during the year, together with statements regarding the operations of the various agricultural banks.

Second annual report of the department of foods and markets, 1915 (*Ann. Rpt. Dept. Foods and Markets, N. Y., 2 (1915), pp. 33*).—In this report are discussed the activities of the bureau in securing better market conditions, market facilities, and prices for farm products. Its efforts were principally devoted to the marketing of fruit, hay, live stock, and live stock products.

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt., 2 (1916), No. 11, pp. 109–120, fig. 1*).—Among the data in this report are a summary of farm prices, the estimated farm value of important products, the range of prices of agricultural products at important markets, and the estimated crop conditions November 1, 1916. It also includes special reports regarding the wheat supply and distribution per capita for a series of years, hop production and consumption, milk prices, the prices of turkeys, chickens, upland middling cotton at New Orleans, alfalfa, and clover seed, the damage to wheat due to black rust in North Dakota, South Dakota, and Minnesota, the wheat surplus and deficiency by States, index figures of total crop yields for a series of years, the potatoes moved from counties where grown and the quantities harvested by months, celery acreage, honey, pecan, and onion production, etc.

Food and raw material requirements of the United Kingdom (*London: Dominions Roy. Com., 1915, pp. IV+123*).—This report, prepared by the Royal Commission on the Natural Resources, Trade, and Legislation of Certain Portions of His Majesty's Dominions, indicates the requirements for the various food products, the sources of supply, and the quantities consumed for 1913–14 and previous years.

Prices and supplies of corn, live stock, and other agricultural produce in England and Wales, R. H. Rew (*Bd. Agr. and Fisheries* [*London*], *Agr. Statis., 50* (*1915*), *No. 3, pp. 103–151*).—This bulletin continues data previously noted (E. S. R., 34, p. 491), adding statistics for 1915.

Agricultural statistics of Ireland, with detailed report for the year 1914 (*Dept. Agr. and Tech. Instr. Ireland, Agr. Statis. 1914, pp. XXI+143*).—This report continues the information previously noted (E. S. R., 31, p. 895) by adding data for 1914, and contains a special report comparing the acreage devoted to crops, the number of live stock, and number of agricultural holdings as found in 1914, with a series of years extending back to 1867.

[Agricultural statistics for the Netherlands] (*Jaarc. Konink. Nederlanden, Rijk Europa 1914, pp. 203–228*).—These pages continue information previously noted (E. S. R., 33, p. 894), adding data for 1914.

[Agricultural statistics in Switzerland] (*Statis. Jahrb. Schweiz, 24* (*1915*), *pp. 74–82*).—These pages continue data previously noted (E. S. R., 35, p. 590).

A B C of Queensland statistics, 1916, compiled by N. J. MacLeod (*Brisbane: Govt., 1916, pp. 42*).—This continues data previously noted (E. S. R., 34, p. 792).

[Agriculture in Ceylon] (*Ceylon Blue Book, 1915, pp. V 1–V 17*).—These pages of this volume contain data regarding the area, production, and prices of crops, number of live stock, and wages of agricultural labor by provinces and districts.

Agriculture in Portuguese Angola, D. Taruffi (*Agr. Colon.* [*Italy*], *10* (*1916*), *No. 8–9, pp. 385–431, pls. 12*).—In this article are discussed the topography, climate, extent of agricultural development, types of crops, and live stock produced in this region.

International yearbook of agricultural legislation (*Inst. Internat. Agr.* [*Rome*], *Ann. Internat. Leg. Agr., 5* (*1915*), *pp. XCII+1460*).—This volume continues the information previously noted (E. S. R., 34, p. 91) by adding the most recent laws and regulations.

AGRICULTURAL EDUCATION.

The change of stress in making the curriculum from subject-matter to the individual, A. C. True (*High School Quart.* [*Ga.*], *4,* (*1916*), *No. 4, pp. 261–267*).—In the author's opinion, the general tendency to give all vocations the professional basis and attitude is reflected in secondary and higher educational institutions in the broadening of courses and the constantly increasing number of subjects taught, resulting in a demand for expert guidance and particularly for vocational guidance. This state of things is putting a tremendous burden, financially and morally, on both public and private schools and colleges.

"Studies in the science of pedagogy are bringing out facts regarding the development of the mind through childhood and adolescence, the actual conditions with reference to the effect of memory studies, observation, manual exercises, etc., on the student's mind as related to his inclinations, interests, and aptitudes. These studies show the great variety of factors which enter into the effective education of the individual and the reaction of the different factors on the peculiar type of mind which the individual is endowed with. Therefore, while there are certain things which all children should be taught there must be increasing differentiation of subject-matter and methods of instruction as the individual mind develops and becomes more definitely related to the world of nature and vocations in which the fully developed man or woman is to work."

The individual youth must choose the subjects that he will study and it is the duty of educational institutions to study the individual student and give

him the best advice they can on the basis of his make-up and requirements. "They ought not to hold him within the limitations of their own curriculum, which because of lack of means or of the aim of the institution may be very narrow."

It being impossible for any one school or college to teach everything, there is a growing tendency to put all education on a public foundation. The State or Nation, with the wealth at its command, can so arrange its educational institutions that taken together they will provide instruction in all subjects, except perhaps theology. Through scholarships or other means it can enable students to easily move about from one institution to another wherever located. To compete successfully with public institutions private schools will be more and more compelled to associative effort accompanied by individual differentiation. "There are many arguments in favor of colleges having from 500 to 1,000 students in undergraduate work. These usually can not cover a wide range of work, and the student should choose the college best adapted to his requirements. One thing is absolutely certain, that the attempt to run colleges on the narrow curriculum in vogue 50 years ago will be a complete failure, or if it has in some instances partial success it will be an injury to many of the students."

Agriculture, O. H. BENSON and G. H. BETTS (*Indianapolis: The Bobbs-Merrill Co., 1915* [*16*]+*444*+*XI*+[*16*], *figs. 189*).—The text for the farm previously noted (E. S. R., 33, p. 95) was also issued in the same year as a text for the school and farm, including in addition, at the end of the book, instructions to teachers on public school extension work, equipment, laboratory material, method of instruction, seasonal order of study, and reference material.

Agriculture, O. H. BENSON and G. H. BETTS (*Indianapolis: The Bobbs-Merrill Co., 1916, pp.* [*16*]+*520*+*XIX, pl. 1, figs. 211*).—The above text has also been adapted to Southern and Western conditions. Chapters have been added on Agriculture in the South, Agriculture in Western States, Farming Under Irrigation, Cotton, Tobacco Culture, Sugar Farming, Culture of Citrus, Fruits and Nuts in the South and West. The chapter on Home Canning of Fruits and Vegetables has been extended to include the canning of soups and the description of the five common methods of canning in use, canning equipment, tinning, capping, and soldering, repair work, etc.

Introduction to agriculture: Practical studies in crop production, C. M. WEED and W. E. RILEY (*Boston: D. C. Heath & Co., 1916, pp. VI+268, figs. 131*).—A chapter on Soils: Their Origin, Characteristics, and Improvements, has been added to this text, which has been previously noted (E. S. R., 32, p. 393).

Elementary agriculture for Alberta schools, J. McCAIG (*Toronto, Canada: W. J. Gage & Co., Ltd., pp. X+11–256, pls. 40, figs. 45*).—This elementary text for Alberta schools comprises five parts dealing respectively with the soil; the life cycle of the general plant; tillage, with particular reference to prairie agriculture; representative crops; types of farm enterprise; and types and breeds of farm animals. Each chapter includes practical exercises to be done in the school, home and school garden, and field.

Agricultural education and research (*Rpt. Bd. Agr. Scot., 4* (*1915*), *pp. XIV–XIX*).—An account is given of the progress in 1915 in agricultural education and research work under the control of the Board of Agriculture of Scotland.

A county scheme for training women for farm work, R. N. DOWLING (*Jour. Bd. Agr.* [*London*], *23* (*1916*), *No. 4, pp. 349–353, pl. 1*).—The author describes a scheme of the Lindsey Education and War Agricultural committees for overcoming the prejudices against the employment of women in farm work

in areas of Lincolnshire other than in the South and North where women have been extensively employed in such work. A County Training and Clearing House Station accommodating 12 women at a time was organized at Elkington, near Louth, where free instruction extending on an average through two weeks is given in such subjects as weeding corn, hoeing roots, milking, hay making, etc. Wages are paid by the estate for work done that is of value to the farm which may more than cover the nominal fee for board and lodging. Nineteen students, representing women of both the industrial and well-educated classes, had completed the two-weeks course, and three a one-week course. It is reported that farmers prefer the well-educated women, although all the women placed seem to have given satisfaction.

Nature-study in Rhode Island, W. G. VINAL (*Nature-Study Rev., 12 (1916), No. 6, pp. 253–262*).—In this lecture, given in the extension course of the Rhode Island Normal School, three large phases are distinguished in nature study, namely, the plant-animal phase or community nature study, coming in the first six grades, the physics-chemistry phase, and the gardening phase—school gardening in the fifth and sixth grades and home gardening or home science in the seventh grade, broadening into civic science in the eighth grade. The author states that nature study is usually limited to the plants and animals and elementary science to physics and chemistry. They are both scientific and they are both nature study, the only difference being that in nature study emphasis is placed on the appreciative side whereas in elementary science the subject is placed first. He discusses the value of nature study, organization of material, method of teaching and aids, such as museums, field trips, illustrative material, and exhibits. It is recommended that the material selected include the daily problems of science which are met by the pupils, other things and that every one should know, and the individual needs of the neighborhood, and that the instruction be given by means of illustrations followed by project work.

September nature-study, ANNA B. COMSTOCK (*Nature-Study Rev., 12 (1916), No. 6, pp. 280–289, figs. 4*).—The author outlines nature study topics for grades 2, 3, 4, and 5 to be used in connection with her Handbook of Nature Study.

Home school gardens (*Agr. Gaz. Canada, 3 (1916), No. 7, pp. 638–647, figs. 2*).—This is a collection of articles on the method of conducting home school gardens, their inspection, the number of gardens, etc., in the Provinces of Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, and Saskatchewan.

[School home gardening] (*U. S. Dept. Int., Bur. Ed., School Home-Garden Circs. 1915, Nos. 1, pp. 4; 2, pp. 4; 3, pp. 3; 4, pp. 2; 1916, Nos. 5, pp. 5, figs. 2; 6, pp. 4; 7, pp. 6; 8, pp. 3; 9, pp. 3; 10, pp. 4; 11, pp. 14*).—These circulars, intended to help teachers and garden supervisors, deal respectively with (1) Instructions for School-supervised Home Gardens, (2) A Course in Vegetable Gardening for Teachers, (3) The Winter Vegetable Garden [in the South], (4) Organic Matter for the Home Gardens, (5) Hotbeds and Cold Frames for Home Gardens, (6) Raising Vegetable Plants from Seed, (7) How to Make the Garden Soil More Productive, (8) Planting the Garden, (9) Part Played by the Leaf in the Production of a Crop, (10) A Suggestive Schedule for Home-garden Work in the South, and (11) List of Publications for the Use of School Home-garden Teachers.

A brochure on school gardens, H. J. DAVIES (*Dept. Land Rec. and Agr., United Prov. Agra and Oudh, Bul. 34 (1915), pp. 17*).—Instructions for school flower gardens in the hills and plains of the United Provinces of Agra and Oudh, India, are given.

Equipment for teaching domestic science, Helen Kinne (*Boston: Whitcomb and Barrows, 1916, pp. [6]+104, pls. 16, figs. 28*).—In this revision (E. S. R., 25, p. 393) chapters are added on Portable Equipment for Lectures, and New Developments in Household Arts Equipment, including the practice house, the school apartment, the unit kitchen, and the school lunch room as a cooking laboratory.

Food and nutrition laboratory manual, Isabel Bevier (*Boston: Whitcomb and Barrows, 1915, pp. 80*).—To this manual, previously noted (E. S. R., 20, p. 775), considerable new material has been added, and the classification and methods of experimentation have been revised on the basis of present knowledge.

Clothing and health, Helen Kinne and Anna M. Cooley (*New York: The Macmillan Co., 1916, pp. VII+302, pl. 1, figs. 150*).—This is an elementary textbook, in story form, dealing with elementary processes in sewing, making simple garments, care and repair of clothing, choosing and wearing clothes, and leading textile materials.

MISCELLANEOUS.

Program of work of the United States Department of Agriculture for the fiscal year 1917, E. H. Bradley (*Washington: Govt., 1916, pp. 502*).—The proposed activities of this Department are set forth in project form.

Report of Porto Rico Station, 1915 (*Porto Rico Sta. Rpt. 1915, pp. 45, pls. 3*).—This contains the organization list, a summary by the agronomist in charge as to the general conditions and lines of work conducted at the station during the year, reports of the chemist and assistant chemist, horticulturist, assistant horticulturist, plant pathologist, and entomologist abstracted elsewhere in this issue, and a special article entitled A Porto Rican Disease of Bananas noted on page 352.

Twenty-eighth Annual Report of Texas Station, 1915 (*Texas Sta. Rpt. 1915, pp. 43, figs. 2*).—This contains the organization list, a financial statement for the federal funds for the fiscal year ended June 30, 1915, and for various state funds for the fiscal year ended August 31, 1915, and a report of the director on the work of the station and the various substations.

Monthly Bulletin of the Ohio Agricultural Experiment Station (*Mo. Bul. Ohio Sta., 1 (1916), Nos. 10, pp. 289–320; 11, pp. 321–352, figs. 12*).—These numbers contain, in addition to several articles abstracted elsewhere in this issue, the following:

No. 10.—Influence of Sulphur on Crop Production, by J. W. Ames and G. E. Boltz, an abstract of Bulletin 292 (E. S. R., 35, p. 220); Mulching the Apple Orchard, by F. H. Ballou, an extract from Bulletin 301 (E S. R., 36, p. 40); and The Ohio Soil Survey, by W. C. Boardman.

No. 11.—Roughages for Fattening Lambs, by J. W. Hammond, an abstract of Bulletin 245 (E. S. R., 28, p. 671); Producing Mulch Material in Apple Orchards, by F. H. Ballou, an extract from Bulletin 301 (E. S. R., 36, p. 40); Observations on the Wheat Harvest of 1916, by C. G. Williams; Fall Steaming of Tobacco Plant Beds to Prevent Root Rot, by A. D. Selby, T. Houser, and J. G. Humbert; and Problems of the Southeastern Ohio Farmer, by C. W. Montgomery.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 4 (1916), No. 8, pp. 16, figs. 5*).—This number contains brief articles on the following subjects: Production Costs in Dairying, by H. L. Blanchard; Improve Soils by Drainage, by E. B. Stookey; The Logic of the Winter Feeding Schedule, by Mr. and Mrs. G. R. Shoup (see p. 373); Spur Blight of Red Raspberries, by A. Frank; Trap the Moles Now; and Winter School for Farmers.

NOTES.

Alabama College and Station.—Dr. J. T. Anderson, professor of chemistry and chemist for soil and crop investigations, died February 25, at the age of 67 years. Dr. Anderson had been connected with the institution for twenty-nine years. Much of his station work had been in connection with the fertilizer inspection, but he had also studied for a long time the nutrition of the cotton plant and had in progress an Adams Act project on the determination of the fertilizer requirements of the soil by analysis of the cotton plants grown on it. He had also been studying the factors affecting the application and insecticidal efficiency of arsenicals. He was an early worker in the Association of Official Agricultural Chemists and was an abstractor for several years from that association for *Experiment Station Record.*

Miss Madge J. Reese, state home demonstration agent, and Miss Mary Paxton, assistant state home demonstration agent, have resigned.

California University and Station.—Four-year professional courses in forestry and forest engineering have recently been established. A twelve weeks' short course is also being given, beginning January 15, to help practical woodsmen. The work includes theoretical training in surveying, log-scaling, timber estimating, logging, fire protection, silviculture, forest administration, trail and telephone construction, English composition, grazing, and the work of the United States Forest Service.

Arnold V. Stubenrauch, professor of pomology and pomologist, died February 12. Professor Stubenrauch was born in New Orleans, April 27, 1871, and was graduated from the University of California in 1899. In 1901 he received the M. S. degree from Cornell University and for the next year was instructor in horticulture in the University of Illinois. In 1902 he returned to California, serving until 1905 as assistant professor of horticulture. For the next ten years he was connected with the Office of Horticultural and Pomological Investigations of the U. S. Department of Agriculture, for several years with the studies of fruit transportation and storage, and subsequently in charge of the Office until his return to California in 1914. He was a member of numerous horticultural and general scientific societies and the author of a long list of publications of this Department, the California Station, etc.

Professor Stubenrauch was most widely known for his studies of the handling, transportation, and storage of fruits, which led to important changes in methods, especially in California and Florida. He determined the fundamental factors underlying the successful storage of California grapes and discovered the availability of redwood sawdust as a packing material.

Georgia Station.—R. W. Allen has been appointed assistant chemist, beginning February 15.

Kentucky Station.—L. B. Mann has been appointed assistant in the department of animal husbandry.

American Society of Agricultural Engineers.—The tenth annual meeting of this society was held at Chicago December 27–29, 1916.

One of the topics of special interest was the farm tractor. An inquiry as to the Status of Tractors in Nebraska was reported by L. F. Seaton. Question blanks were sent to about 550 owners in all parts of the State, and reports re-

ceived from 215 owners. Unfavorable reports were followed by personal interviews, and it was usually found that the owner was either not making a success of any farm work or, while a good farmer, he was not a mechanic and depended upon inexperienced men to handle the tractor.

Of the total number of owners reporting for the period 1912–1916, 68.6 per cent considered the tractor a good investment, and of the owners reporting for 1915–16, 76.5 per cent so considered it. All things considered, the tractor was thought to be more satisfactory than the horse by 54.4 per cent of the total number reporting, and by 61.1 per cent of those reporting for 1915–16. As to the cost of operation and maintenance, 65.8 per cent reported in favor of the tractor. From the reports made by the total number reporting, it was thought that the tractor would not be a good investment on farms under 270 acres, but the 1915–16 reports indicated 230 acres to be sufficiently large.

The machines were used an average of 66 days a year. The average length of day was 11.8 hours, with 1.25 hours additional required for oiling and general care. The average size of tractors was from 10.31 to 22.1 horsepower, and the average cost of tractors $564.23. The average cost of repairs was about $42.50 for the whole year.

The average width of gang used for plowing was 4.46 ft. or four plows, while that used for breaking was 5.2 ft. or about five plows. The rate of speed traveled per hour was 2.48 miles for plowing and 2.24 miles for breaking. The average amount of fuel used per day for plowing was 26.25 gal., at a cost of $3.50, and for breaking 40 gal. at a cost of $6.96. The amount of lubricating oil used per day for plowing was 1.77 gal. at a cost of 87.3 cts.; and for breaking 2.52 gal. at a cost of $1.25.

F. N. G. Kranich discussed The Tractor's Relation to the Farm and its Machinery. It was pointed out that the relation of the tractor to the plow is well established and that the plows now used are of special design, horse-drawn gang plows being used in very few cases. It was considered doubtful, however, whether or not the tractor will bring about similar changes in other farm draft and belt power machines. Nearly all the seeding and harvesting machinery in present use is built in units too small to be used economically with the tractor, indicating the necessity of designing this type of machinery so that it may be drawn either by horses or by a tractor. The relation of the tractor to belt power machines does not necessitate a change in machine design, but does necessitate a careful choice on the part of the purchaser as to size so that the tractor will have ample power to drive the machines at their full capacity. The necessity was also pointed out of selecting a tractor and the machinery to go with it in sizes that will prove a paying investment on the farm in question, and of making sure that this machinery will be used a sufficient amount of time during the year to make the proposition a paying one.

E. R. Greer, in a paper on Developments in Tractor Design, stated that the developments during the past season have been mostly in the perfection of details. There has been no radical change in the general design of tractors and no type on the market has been eliminated because of its unfitness. An improvement considered very important by the author is the general adoption of a device for clearing the air of dust before it enters the engine cylinder. It was stated further that all types of tractor motor may be equipped with devices so that kerosene may be burnt successfully, but as a rule the power capacity will be about 10 per cent less in burning kerosene than in burning gasoline.

In a paper on The Standardization of Gas Tractor Ratings, R. W. Olney advocated the universal rating of tractors in terms of belt and drawbar horsepower and drawbar pull, as previously explained (E. S. R., 35, p. 890).

O. E. Bransky gave an illustrated talk on Fuels for Internal Combustion Engines, discussing the physical and chemical properties of gasoline and kerosene, including a description of the usual methods followed in producing gasoline and kerosene from crude oil and the so-called Burton process. An evaporation test by means of which the percentages of fuel which are evaporated at different temperatures are determined accurately was advocated in place of the hydrometer test.

In a paper on Magneto Characteristics, it was shown by J. G. Zimmerman from results of tests of two small gas engines that the heat required in both a high tension and make-and-break ignition spark is approximately 0.0025 calorie. The heat value is considered to be the essential factor in the ignition spark, but this heat value must be delivered within a very short period of time. The paper dealt further with sparks, voltage, timing, and the theory of electromagnetic spark generation, the author's purpose being to show how different types of magnetos are designed to produce the kind of spark which is desirable for gas engine ignition.

H. E. Murdock reported on the Drainage of Irrigated Lands, especially as practiced at the Montana Experiment Station. The relief and intercepting systems of drainage were discussed, and special cases of drainage of seeped lands in Montana described in which the use of the systems noted was illustrated. It was brought out especially that the drainage of seeped irrigated lands requires more than a simple survey for the preliminary work. "When drainage of a tract of land is successfully accomplished the work of reclaiming the land is not yet completed, as the soil of the old swamp needs to be put into condition for crops." "The question as to whether it will pay to drain a certain piece of land needs careful consideration as the expense of reclaiming it may be greater than the value of the land; however, it can generally be stated that it pays to drain seeped areas in irrigated lands unless the conditions are very unfavorable for their successful reclamation."

In a discussion of the above paper by O. W. Israelson, results of work reported by the Irrigation Investigations of the U. S. Department of Agriculture were reviewed.

G. W. Iverson presented a paper on Stresses in a Shawver Barn Truss, explaining methods of graphical and analytical computation of stresses. It was shown that this plank truss type of barn frame as usually built should be strong enough to withstand a wind blowing at the rate of 90 miles per hour.

Barn Planning was discussed by W. A. Ashby, who took up the independent stable, shed, loft, basement, and covered barnyard types of live stock barns. The requirements of each type were summarized and translated into figures giving data regarding the average unit space and space for doors, windows, vent flues, and floors, height of ceiling, and width and length of stall for sheep, loose cattle, horses, and milch cows. On the basis of this material a concrete example of barn planning was worked out step by step, illustrating the points discussed and the application of the data.

M. L. King presented a paper on Hollow Clay Blocks for Farm Buildings. The development of permanent and fire-proof farm structures as well as features of their design were dealt with, and a standard test for fire-proof farm residence construction was proposed, based on the author's experience.

A paper on Masonry Roofs, based on experimental work at the Iowa Experiment Station, was presented by W. G. Kaiser. The general features of design of a reinforced concrete and hollow tile arch barn roof following the equation of an inverted catenary were discussed.

Other papers included that on College Instruction in Concrete Construction, by A. J. R. Curtis, prepared from the standpoint of the teacher; Short-course Instruction in Gas Engines and Tractors, by L. F. Seaton, in which the practice in this connection of about twelve agricultural and mechanical colleges in the Central West was outlined; Standardization of Sprocket Wheel Design, by W. F. MacGregor, discussing a paper on the same subject presented by F. N. G. Kranich at the 1915 meeting; Cotton Machinery, by E. C. Gee, based on experience at the Texas College; Use of the Tractor on Eastern Farms, by H. R. Burr, based on work conducted at the Williamson School of Delaware County, Pa.; The Arrangement and Planning of the Farmstead, by L. W. Chase and M. C. Betts, who covered in a semi-popular way the arrangement of farm buildings, lots, etc., with reference to practically every ordinary type of farm activity; What Should the Farmhouse Cost, by W. A. Etherton, who presented data collected showing the relation of house rent to the weekly income of 7,570 families in 29 cities and the relation of the incomes of 1,363 farms in nine States to the cost of the tenant houses thereon; Electric Equipment for the Farm by W. K. Frudenberger; and Agricultural Engineering Bibliography, by H. E. Horton, proposing to add to the generally accepted classification of agricultural engineering three more divisions, namely cultural, statistical, and economic.

E. M. Merwine presented the report of the farm power machinery committee. This consisted of a report of tests on the power requirements of two corn grinders, three alfalfa grinders, two silage cutters, and a corn husker and shredder.

The committee on farm power, L. F. Seaton chairman, reported tests on the compaction of soils due to the use of tractors, made by the agricultural engineering and agronomy departments of the University of Nebraska. The tests were conducted on stubble and freshly plowed land of fine sandy loam soil, which at the time was in very dry and compact condition. Four types of tractor were used, namely, the light-weight four wheel, the drum drive, the caterpillar, and the heavy-weight four-wheel types. Samples of soil were taken to a depth of 6 in. and sometimes to a depth of 12 in. to determine the weight of the soil in a given volume of space in places where the tractor had passed over. The results showed that very little packing of the soil occurred in stubble ground, and in several cases the ground was looser after the tractor had passed over it than before. This is tentatively attributed to the grouters and the slipping action of the wheels. There was considerably more packing when the moisture content of the soil was higher.

W. F. MacGregor reported the progress of the activities of the committee on tractor ratings.

I. W. Dickerson presented the tentative recommendations of the standards committee on the standardization of the ratings and specifications of low voltage farm electric lighting plants. These consisted essentially of suggestions as to the information which manufacturers of farm electric lighting plants should give in their ratings and specifications.

The report of the committee on sanitation included among other matters a review of about 95 reports on the purification and disposal of rural and farm sewage and on farm and rural water supplies, obtained during the past year from various sources.

Other committees reporting were those on farm structures, tractor demonstrations, tractor ratings, irrigation, and drainage.

E. B. McCormick of the Office of Public Roads and Rural Engineering of this Department, was elected president for the ensuing year. C. K. Shedd of the Iowa College continues as secretary-treasurer.

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EXPERIMENT STATION RECORD.

VOL. 36. APRIL, 1917. No. 5.

The annual agricultural appropriation act continues to be a document of wide public interest. It constitutes an epitome of the organization and mechanism of the Federal Department of Agriculture and reveals its many and intimate relations with the daily life of the whole American people. In a sense it is an indicator of current opinion as to the most pressing problems of American agriculture and the ways in which an institution of this sort may be expected to aid in solving them. It furnishes a convenient measure of the Department's progress from year to year, as well as a forecast as to its activities and lines of development in the months to come.

The latest of these acts, covering the fiscal year ending June 30, 1918, was signed by President Wilson March 4, in the closing hours of the Sixty-fourth Congress. It was thus enacted only a little over six months subsequent to the belated measure for the current fiscal year; yet it is much more than a mere routine extension of it. Unlike the former act, it contains comparatively little general legislation and inaugurates no single project of outstanding prominence, but it increases a large number of the allotments for the Department's work and affords scope for its development in a number of important ways.

Many of the enlarged appropriations are to provide for its increased administrative and regulatory activities, and for the growth of such enterprises as the cooperative demonstration work in the Northern and Western States, the market news service, the development of dairying and animal husbandry, additional soil surveys, and the improvement of the National Forests. It materially enlarges the funds for the combating of a number of serious pests and diseases of animals and plants, notably tuberculosis, hog cholera, dourine, the pink bollworm of cotton, citrus canker, and white-pine blister rust. It provides additional funds for fiber-plant and cereal studies, biological studies of food and drug products, studies of the relative utility and economy of agricultural products for food, clothing, and other purposes in the home, and for various other projects.

The act converts the Office of Markets and Rural Organization into the Bureau of Markets, and contains a new item of $50,000 authorizing the bureau to investigate the handling, manufacture,

and distribution of agricultural food products, with special reference to the manipulation of markets or the control of food supplies. The Secretary of Agriculture is empowered, in the discharge of the duties required by the act relating to the Bureau of Markets, to administer oaths, examine witnesses, and call for the production of books and papers. The establishment of an additional experiment station in Alaska and of a weather bureau station at Greenville, South Carolina, are authorized. Provision is made for a $75,000 laboratory building on the Department's experimental farm near Arlington, Virginia, as permanent quarters for the testing and research work of the Office of Public Roads and Rural Engineering. The act also contains authority to purchase 150 acres of land at Chico, California, in connection with the plant-introduction work, and about 600 acres for the Morgan Horse Farm near Middlebury, Vermont.

The Plant Quarantine Act of 1912 is amended in two important particulars. The Secretary of Agriculture is now given discretionary power to quarantine any State or Territory when in his opinion such quarantine is necessary to prevent the spread of a dangerous plant disease or insect infestation. The scope of the quarantine itself is broadened by the inclusion of stone or quarry products or any other article deemed capable of disseminating a dangerous plant disease or insect infestation.

The appropriations carried in the new act aggregate $25,929,113. This is an apparent decrease of $1,019,739 over the total in the current act, but if comparison is attempted between the two fiscal years, allowance must be made for the sum of $2,000,000 appropriated in the act for the fiscal year 1917 for purchases of land under the Appalachian Forest Reserve Act but not to be expended until the following fiscal year. If the aggregates are corrected accordingly, the appropriation available for 1918 becomes $2,980,261 in excess of that for 1917, or slightly over eleven per cent.

The new act also carries another increase, in common with several other appropriation acts for the support of other branches of the government, in the form of an indefinite appropriation of such amount as is necessary for additional compensation during the fiscal year of certain full-time employees of the Department. Those receiving less than $1,200 per annum are granted a salary increase of ten per cent, and those receiving from $1,200 to not more than $1,800, one of five per cent. Persons receiving a part of their salaries from outside sources under cooperative arrangements with the Department are not included in this provision. It is estimated that about 12,000 of the more than 17,000 employees of the Department will be affected, and that approximately $900,000 will be expended for this purpose.

Taking up the allotments of the various bureaus and offices in turn, that of the Weather Bureau is $1,783,140. An increase of $30,380 is granted to provide for the normal growth of the service; $10,000 for the studies of the efficiency of various methods of frost protection for the benefit of orchardists, truck growers, and others; and $10,000 for additional equipment for storm warning towers on the Gulf coast.

The appropriations directly allotted to the Bureau of Animal Industry aggregate $3,555,326, but this is, as usual, supplemented by the permanent appropriation of $3,000,000 per annum for meat inspection and other funds provided elsewhere in the act. The total corresponding allotment for the current year is $3,020,746, so that the increase is considerable—in fact, one of the largest provided for any bureau.

The inspection and quarantine work of the bureau against animal diseases receives $628,280, an increase of $103,500. Of this amount $75,000 is expected to be used for the development of methods for eradicating tuberculosis in live stock, testing on a larger scale methods which have proved successful in controlling the disease in small areas. It is also planned to use $25,000 in the inspection and supervision of the disinfection of infected hides, wool, and other animal by-products, with the view of preventing the introduction of dangerous diseases from the new sources of supply instituted by the Europpean war. The remaining increase is to meet the enlarged demand for tuberculin and blackleg vaccine.

A slight extension of the field hog-cholera campaign is provided for by an increased appropriation of about $15,000, the total for this purpose being $210,000. There will also be available $172,240 for the enforcement of the virus-serum-toxin provisions of the act of 1913 and $32,060 for research work. The dourine appropriation is increased from $75,000 to $99,000, of which $50,000 is made immediately available. This infection has been found to be prevalent over a wider area than was at first anticipated.

The tick eradication campaign is given $631,560, of which $50,000 may again be used for live stock and dairy demonstrations in cooperation with the States Relations Service in areas freed of ticks. It is of interest to note that during the past year 16,281,185 inspections were made of cattle for ticks; that 12,662 cattle dipping vats were in operation under Federal or State supervision; and that 31,358 square miles of territory were released from quarantine because of the eradication of the disease.

The allotment for investigations of animal diseases is $134,600, of which $50,000 may be used for contagious abortion. The emergency appropriation for the eradication of foot-and-mouth and similar con-

tagious diseases is reduced from $1,250,000 to $1,000,000, plus any unexpended balance remaining from the fiscal year 1916.

The supplemental appropriation for meat inspection is $501,620, a net increase of $141,600 over the funds for the current year. This will provide for the supervision of some additional establishments and of new departments being added to existing plants.

The recent noteworthy increase of interest in dairying is reflected in an enlargement of the appropriation for that work by $117,020, or to a total of $378,930. It is proposed to extend especially the studies and demonstrations of dairy farming; the promotion of dairy manufacturing through creameries in the South and cheese factories in the South and West; dairy research; the market-milk studies, including dairy sanitation, extension work, and problems in milk-plant management; and to begin a campaign to improve the character of dairy products produced and consumed on the farm.

The allotment for animal husbandry is increased $81,080, the total for this purpose being $277,580. More attention is to be given to farm sheep, notably in the Middle West and Eastern States, including studies and demonstrations in cooperation with the States Relations Service and the agricultural colleges. A grant of $12,280 is also included for the equipment of the United States sheep experiment station in Fremont County, Idaho. Studies of beef production in the corn belt in cooperation with the Office of Farm Management are contemplated, and the extension of the pig club and poultry club work is planned for several additional States.

The special appropriation of $60,000 for experiments and demonstrations in live stock production in the cane sugar and cotton districts is continued, as is also that of $40,000 for somewhat similar work in the semiarid and irrigated districts. The first-named project is being carried on largely in cooperation with the State of Louisiana, and the experimental work thus far has been mainly with forage-crop production, cattle feeding, and mule raising. Under the second project buildings and equipment are being provided at Ardmore, South Dakota, and Huntley, Montana.

A large increase is also granted for the Bureau of Plant Industry, its total rising from $2,537,120 to $3,143,630. This increase is mainly for the combating of plant diseases, especially citrus canker and white-pine blister rust. For the citrus-canker campaign $180,000 additional is provided, making $430,000 for the purpose. The increase is immediately available, while it is made discretionary with the Department as regards the remaining $250,000 to require contributions of an equal amount from other sources. A similar arrangement is made with regard to the $300,000 appropriation for white-pine blister rust, half of which is made immediately available and the remainder contingent, in the discretion of the Department,

upon equivalent outside contributions. No part of the appropriation for either disease may be used in payment for trees or other property injured or destroyed.

Small increases are also provided to combat several other diseases, notably root rot and similar tobacco troubles, Stewart's disease of sweet corn, a new bacterial disease of wheat, cranberry rot, and some of the diseases of prunes, cherries, pecans, watermelons, tomatoes, lettuce, celery, beans, and alfalfa and other forage plants. Provision is also made for the organization of a plant-disease survey of the United States, with an allotment of $10,000. Work under this line has hitherto been conducted incidental to the various special inquiries in progress, and it is hoped that this centralization will assist in the estimation of the economic importance and distribution of plant diseases, the discovery and identification of new fungi, the supplying of material to investigators, and in similar ways.

The allotments for crop acclimatization and fiber-plant investigations have been combined and carry a total appropriation of $82,510. Of this amount at least $7,500 is to be used for experiments with cotton seed interbreeding, and $25,000 is for studies of the feasibility of increasing the production of hard fibers, particularly in the Philippine Islands. The item for testing and breeding fibrous plants, with special reference to paper making, has been increased $5,920 in order to provide for tests of flax tow as a paper-making material.

The sugar-plant studies have been enlarged to include work with sorghums. There is a net increase of $9,000 in this allotment which will be used for an economic and technical investigation of the status of the sorghum industry, for extending the experimental work with cane sirup, and for special studies in the control of the sugar-beet nematode and curly-top disease of sugar beets.

Other increases for the bureau include $22,000 for cereal investigations, $5,000 for a study of the biochemical basis of disease immunity in plants, $6,600 for additional work on the agricultural significance of nematodes, $3,000 for seed testing, $4,500 for developing methods for decreasing the losses of tobacco resulting from weather conditions, $5,000 for promological studies with a special allotment for work with pecans, and $7,500 for the further development of the Arlington Experimental Farm.

The foreign seed and plant introduction work receives a net increase of $23,000, of which $8,500 is for developing methods for the protection of new plant introductions; $4,500 for improving the facilities at the field stations at Miami, Florida, and Chico, California; and $10,000 for establishing an additional station at Bellingham, Washington. The Congressional seed distribution is continued on the customary basis, with an allotment of $243,720.

The appropriations for the Forest Service, as usual, are greater than those of any other bureau, aggregating $5,712,275, with $100,000 additional for cooperation with the States in fire protection work under the Appalachian Forest Reserve Act. As previously noted, there will also be available for expenditure during the fiscal year 1918 the $2,000,000 provided for land purchases in the appropriation act of the current year.

The bulk of the appropriation is to be utilized for the administration, protection, and development of the National Forests, which it is of interest to note returned in receipts for the fiscal year 1916 a total of $2,823,540.71. There are a number of increases in the funds for administrative work, and the allotment for permanent improvements has been increased from $400,000 to $450,000. This will be used in particular for additional fencing and similar improvements with a view to increase the stock-carrying capacity of the ranges.

The experimental work of the Service is provided for much as usual, with an increase of $5,000 to extend the grazing and range studies, and a net increase of $25,000 for the studies of forest products and the demonstration of the results on a commercial scale.

The Bureau of Chemistry receives $1,200,591, of which $623,521 is allotted for the enforcement of the Food and Drugs Act. Authority to establish standards of the strength, quality, or purity of articles of food and certain drugs was refused.

Most of the lines of work of the bureau are continued unchanged. A new item of $7,000 is inserted providing for a study of methods for the manufacture of table sirup, which work has heretofore been carried on under a special allotment of $4,000 from the Bureau of Plant Industry. The bureau is instructed to study methods of determining maturity in fruits and vegetables in cooperation with the Bureaus of Plant Industry and Markets.

The Bureau of Soils is granted $363,735, plus any unexpended balance from the $175,000 appropriation of the current year for experiments and demonstrations of methods of obtaining potash on a commercial scale. There is an increase of $30,000 to extend the soil surveys, as previously noted, and one of $5,000 for additional chemical work and studies of the liming of soils.

There is an increase of $62,600 for the Bureau of Entomology. Of this amount, $25,000 will be used for investigational work relating to the cotton boll weevil, and lesser amounts for special studies of the Hessian fly, chestnut weevils, insects affecting pecans and other nuts, for the control in cooperation with the Bureau of Plant Industry of insect carriers of plant diseases, and for enlarging the work on insecticides. The establishment of a field laboratory in the Ozark Mountain region in Arkansas and a field station in one of the New

England States in connection with work on the apple-tree tent caterpillar is also contemplated. The gipsy and brown-tail moth campaign is again allotted $305,050, but the provision with reference to the manner of establishment and maintenance of quarantines against further spread is made to conform with the provisions of the Plant Quarantine Act. The appropriations for the bureau as a whole aggregate $931,480.

The Bureau of Biological Survey receives $592,070, a net increase of $13,840. This will permit of a more complete enforcement of the Lacey Game Act, and provide for additional protection of some of the seventy Federal bird reserves and five large-game preserves. There is a decrease of $5,000 in consequence of the completion of the inquiries as to the diseases of wild ducks in Utah. The authority to destroy predatory animals is extended to include those which prey upon wild game.

The total appropriation for the States Relations Service is $3,107,660. This is an increase of $137,980, of which $105,200 is to extend the farmers' cooperative demonstration work in the States outside the cotton belt. This will enable the Department to stimulate the development of the county-agent work, the boys' and girls' club work, and the farm-management demonstrations, and make possible a considerable extension of the work with farm women.

There is also an increase of $12,000 for the Alaska Experiment Stations, of which $10,000 is made immediately available for the establishment of an additional station in the Matanuska Valley on the line of the new Government railroad. An amendment authorizing a substation for experimental work with fruits and vegetables in some suitable location in Porto Rico was adopted by the Senate, but eliminated in conference.

The allotment for the Office of Home Economics is increased from $24,220 to $35,000. The work of this office, which deals with the utilization of agricultural products for food, clothing, and other purposes in the home, has hitherto been quite largely with food questions, but it is now hoped to broaden its scope to meet the constantly increasing demand from teachers and housewives for studies of household management and equipment. Opportunity will also be afforded for additional work with various cereal products, green vegetables, the canning of meats in the home, etc.

The remaining lines of work of the States Relations Service are provided for substantially as at present. An increase of $10,000 is granted for administrative expenses, in consequence of the increase in the funds under the Extension Act from $1,080,000 to $2,080,000. The allotments and authority of the Department with reference to

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the State experiment stations are continued unchanged. The cooperative demonstration work in the cotton belt receives $659,560, and the work with farmers' institutes and agricultural schools $20,600.

The act appropriates $701,600 for the Office of Public Roads and Rural Engineering as compared with $599,200 for the current year. Of this increase $75,000 is for the erection of the laboratory building already noted, and $5,000 for an extension of the studies of miscellaneous rural-engineering problems. The remainder will be used to meet the increased demands for studies of road management and road materials in connection with the Federal-aid Road Act. The appropriations under this act for the year will aggregate $10,000,000, of which $300,000 may be used by the Department for the administration of the act, and with $1,000,000 additional for the construction of roads and trails in the National Forests.

The new Bureau of Markets receives $1,718,575, which nearly doubles the allotment to the Office of Markets and Rural Organization in the act for the current year. A considerable part of this increase, however, is due to transfers to the Bureau of duties hitherto not specifically assigned to it. Among these are the grain standardization studies transferred from the Bureau of Plant Industry and increased to $106,590. There is also $519,140, a net increase of $271,340, for the enforcement of the United States Grain Standards Act; $59,620 for the United States Warehouse Act; $98,600 for the United States Cotton Futures Act; and $4,000 for the act of August 31, 1916, to fix standards for Climax baskets and other containers for fruits and vegetables.

A net increase of $71,000 is provided for the market news service as to fruits and vegetables, of which $40,000 is made immediately available for work with crops in transit during the present fiscal year. There are also small increases for the market reports on live stock and meats, the studies of market grades and standards, the cotton standardization work, and for cooperation with the States in marketing studies and demonstrations.

The allotment for the Office of Farm Management is increased from $225,810 to $305,810, thereby allowing for a further extension of the farm-management surveys and the enlargement of some of the survey units. An item of $5,000 carried for several years for studies of the utilization of logged-off lands is omitted.

An increase from $75,000 to $125,000 is provided for the Federal Horticultural Board, which administers the Plant Quarantine Act, to prevent if possible the introduction of the pink bollworm of cotton. This serious pest has recently been discovered in the Laguna district of Mexico and its dissemination is feared through importations of cotton and cotton seed from that country. Strict quarantine pro-

visions are authorized, as well as control measures in cooperation with the States in case infestation occurs.

The work of the remaining branches of the Department is continued on substantially the present basis, both as to funds and lines of work. The Bureau of Crop Estimates is granted $323,452, an increase of $7,016, mainly for the employment of additional field agents and specialists in truck and fruit crops. The Office of the Secretary receives $412,010, in addition to the allotment of the Office of Farm Management already noted; the Division of Accounts and Disbursements, $44,920; the Division of Publications, $213,990; and the Library $50,160. The Department is granted $112,500, an increase of $7,500, for the enforcement of the Insecticide Act; $50,000, an increase of $10,000, to continue and extend the demonstration work on reclamation projects, and $137,500 for miscellaneous expenses. The allotment of $143,689 is made for rent of buildings in the District of Columbia, an increase of $20,000 over the present appropriation, and a joint Congressional committee is authorized to investigate the rental situation in Washington and the estimated cost of construction of sufficient Government-owned buildings to meet the Department's needs.

Among minor items of legislation not hitherto mentioned, the Department is authorized to loan, rent, or sell copies of its moving picture films, giving preference to educational institutions or associations for agricultural education not organized for profit. The President is authorized to extend the usual invitation to other nations to participate in the 1918 meeting of the International Farm Congress, which is expected to be held at Peoria, Illinois.

In a discussion of the appropriation act as a medium for Federal aid to agriculture, the fact should not be lost sight of that increasingly large sums are now available in other ways. Thus, what are known as the permanent and indefinite appropriations for the Department aggregate for the fiscal year $17,235,000, or nearly three-fourths as much as the total carried in the act itself. The largest sources, namely, the Federal-aid Road Act, the meat-inspection provision, and the Extension Act, have already been referred to, the remaining funds being chiefly for payments to the States as their quota of the receipts from National Forests. There is also the appropriation for the Department printing and binding, this year aggregating $600,000, which is carried in the appropriation bill for sundry civil expenses, not yet enacted for the fiscal year 1918.

Of the Federal funds expended outside the Department, the usual appropriation of $2,500,000 will be available for agricultural education under the Morrill and Nelson acts, as well as the smaller grants for the rural education work for the United States Bureau of Edu-

cation, demonstration work among the Indians, the maintenance of the Federal Farm Loan Board, and the payment of the country's quota toward the support of the International Institute of Agriculture. To these has recently been added another large permanent enterprise through the passage of the Vocational Education Act. This measure, signed by President Wilson February 23, 1917, carries among other allotments an appropriation for the fiscal year 1918 of $500,000 for cooperation with the States in secondary education in agricultural subjects, and an additional amount for the training of teachers, supervisors, and directors. It is hoped to present a summary of this important law in a subsequent issue.

Because of the indefinite nature of some of the appropriations, the precise total of the Federal funds for the benefit of agriculture during the year under review can not be predicted, but it is believed it will approximate $50,000,000. Not all of this vast sum, it should be remembered, is expended exclusively for agriculture, for large sums are devoted to regulatory functions of direct service to the public as a whole. Yet it is an impressive showing, especially when it is recalled that it is a virtual doubling of the figures of even five years ago. The expansion in lines of work is even more significant, and indicates the broadened conception of the term agriculture and the legitimate field of the Federal Government in its development.

Progress has, of course, been especially noteworthy along extension lines and in attention to the problems of distribution. From this point of view, perhaps the most significant feature of this period is, as was said by Assistant Secretary Vrooman of the Department in a recent article, "that the Federal Government at last is meeting the farmer at least halfway, and has manifested not merely a willingness but a friendly desire to cooperate with him in the future in any constructive work that looks to the building up of our national prosperity on the basis of a permanently prosperous agriculture."

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Chemical calculations, R. H. Ashley (*New York: D. Van Nostrand Co., 1915, pp. X+276*).—The author has written this text-book for the needs of the student who will later find occupation in chemical laboratory work. The topics discussed are as follows: Ratios, approximate numbers, interpolation, heat, specific gravity, gas calculations, calculation of atomic weights and formulas, gravimetric analysis, volumetric analysis, and use of specific gravity tables and acid calculations. Many original problems are given in each chapter relating to the subject matter discussed.

Chemical constitution and physiological action, L. Spiegel, trans. and enl. by C. Luedeking and A. C. Boylston (*New York: D Van Nostrand Co., 1915, pp. V+155*).—This volume discusses the relation between chemical constitution and physiological action under the headings of general considerations, inorganic compounds, organic compounds of the aliphatic and aromatic series, and nitrogen compounds.

The specificity of proteins and carbohydrates in relation to genera, species, and varieties, E. T. Reichert (*Amer. Jour. Bot., 3 (1916), No. 3, pp. 91–98*).—This article briefly reviews the material previously noted (E. S. R., 31, p. 804).

It is indicated that through these studies a strictly scientific basis for the classification of plants and animals has been found. "There are manifestly certain striking applications that are of the greatest fundamental importance in the study of phylogeny, mutations, reversions, sex, malformations, phenomena of heredity in general." The discovery of the existence of highly specialized stereoisomers has revealed the most remarkable and unsuspected phenomena of living matter, and one which leads directly to the constitutions of various forms of protoplasm and the peculiarities of vital phenomena that are dependent on these differences.

The physiological relation of plant carotinoids to the carotinoids of the cow, horse, sheep, goat, pig, and hen, L. S. Palmer (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 27–32*).—In continuation of the work previously noted (E. S. R., 31, p. 273) the author reports the results of a study of the carotinoids in various animals.

It is concluded that a definite physiological relation exists in all species of animals between the pigmentation of tissue fat with carotinoids and the presence of these pigments in the blood serum. Those species whose tissue fat is colored with carotinoids (cow, horse, and hen) carry the pigments in the blood serum. Species whose tissue fat is characterized by being colorless (swine, sheep, and goat) carry only insignificant traces in the blood serum even under the most favorable conditions.

An abundance of carotin in the blood serum and in the tissue fat is not deemed a specific characteristic of the ruminants, as is indicated by its absence from the blood serum and tissue fat of sheep and goats and its presence in the horse.

The reaction between amino acids and carbohydrates as a probable cause of humin formation, M. L. ROXAS (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 71–93*).—From a study of the effects of various amino acids and carbohydrates as a factor in humin formation during the hydrolysis of proteins, the author found that alanin, leucin, phenylalanin, and glutaminic acid are not important factors in humin formation. Prolin may, however, be involved in the humin formation under certain conditions. In digestion with 20 per cent hydrochloric acid plus sugar the proportion of nitrogen disappearing and responsible for humin formation was for tyrosin, 15 per cent; cystin, 3.1; arginin, 2.33; lysin, 2.62; histidin, 1.84; and tryptophan, 71 per cent. Xylose and fructose were generally more reactive than glucose.

Arginin, histidin, and lysin reacted with sugars more readily in weak acid or aqueous than in strong acid solutions. Arginin, histidin, and tryptophan reacted with a loss of their amino nitrogen, but tyrosin and cystin reacted without any such loss. It appears thus that it is not the amino group of either tyrosin or cystin that reacts with the carbohydrate to form melanin, but probably the OH group in the former and the sulphur linking in the latter.

A possible mode of reaction between the amino acids and the carbohydrates or some degradation product is suggested.

Experimental results are submitted in detailed tabular form.

Tyrosinase and deaminization, K. SCHWEIZER (*Tyrosinase et Désamination. Thesis, Univ. Geneva, Inst. Bot., No. 573 (1916), pp. 117*).—The study reported is considered under the following topics: History, distribution, preparation, properties, action, constitution, and synthesis of tyrosinase; general considerations of deaminization; deaminization by tyrosinase; deaminization by tyrosinase in the presence of phenol; deaminization by tyrosinase in the presence of chlorophyll; and deaminization under anaerobic conditions.

It is concluded that deaminization is not necessarily produced by hydrolytic enzyms, but very readily by oxidases, tyrosinase in particular. The existence of hydrolytic deaminases is rendered highly problematical. The cleavage products of deaminizations by tyrosinase are ammonia, carbon dioxid, and a fatty acid with one less carbon atom than the original substrate. In the animal organism tyrosinase is active in the formation of urea by the degradation of polypeptids and amino acids, not through simple hydrolysis but by oxidation.

A complete list of references to the literature cited is included.

The chymase of Solanum elæagnifolium.—A preliminary note, A. BODANSKY (*Jour. Biol. Chem., 27 (1916), No. 1, pp. 103–105*).—The author has found a chymase in *S. elæagnifolium* (white horse nettle) the properties of which agreed in general with those of other vegetable chymases. It coagulates boiled natural milk without the addition of calcium chlorid, is more resistant to heat than rennin, and obeys the enzym laws in general.

The possible adoption of the enzym preparation by cheese makers as a substitute for rennet extract is indicated and will be further studied.

The preparation and properties of lead-chlor arsenate, artificial mimetite, C. C. MCDONNELL and C. M. SMITH (*Amer. Jour. Sci., 4. ser., 42 (1916), No. 248, pp. 139–145, figs. 2*).

Methods for chemical and microscopical diagnosis, F. A. STEENSMA (*Methoden der Chemische en Microscopische Diagnostiek. Amsterdam: Scheltema & Holkema, 1915, 3. ed., rev. and enl., pp. 157*).—This volume outlines methods for the examination of urine, urine sediment, blood, gastric contents, feces, sputum, pus, exudates and transudates, cerebrospinal fluid, semen, milk, specimens of hair and epithelial tissue, and concretions, and includes notes on the medico-legal examination of such material. Only those methods which

have been found to be perfectly reliable and comparatively simple to manipulate are described.

A new type of extractor, J. B. McNair (*Jour. Indus. and Engin. Chem., 8 (1916), No. 9, p. 838, fig. 1*).—An original type of extractor which has been used successfully in extracting plant material with 86° Baumé gasoline and its manipulation are described in detail.

A comparison of the relative efficiency of laboratory reflux condensers, M. V. Dover and J. W. Marden (*Jour. Indus. and Engin. Chem., 8 (1916), No. 9, pp. 834–836*).—From a critical examination of the efficiency of various lengths of Liebig, Allihn, spiral, Hopkins, Davies, and Friedrichs condensers it has been demonstrated that in order to obtain comparable results the rate of drop back of the liquid must be in approximately equal weights per second. For such a condition it is necessary that the condenser tube be beveled so that the drop returns from one point only. The rate of boiling has very marked influence upon the efficiency of the condenser, as well as the bore and the narrowing at the tip or constriction anywhere in the tube. Such conditions tend to cause choking and consequently disproportionate great loss. For low boiling liquids the length of the condenser is a factor in its efficiency, especially in the Liebig type.

"In experiments where a long condenser can be conveniently used, the Liebig seems to be preferable, because it is a much less costly condenser and can be easily cleaned. Where a short condenser is required, the Friedrichs seems best. The short Liebig or Allihn can be used to advantage only when the rate of condensation is not greater than from 2 to 3 drops per second, or when some means is used, such as a glass-wool plug in the top of the condenser or a test tube inverted over the top of the condenser, to prevent too rapid a carrying away of the vapor by air currents."

Extending the usefulness of a shaking machine, R. M. Chapin and J. M. Schaffer (*Jour. Indus. and Engin. Chem., 8 (1916), No. 10, pp. 921, 922, fig. 1*).—The authors describe fittings which can be applied to a flask-shaking machine so that the machine can be used as a sieve shaker and a shaker for liquids in various other forms of containers.

Aeration method for ammonia, B. S. Davisson, E. R. Allen, and B. M. Stubblefield (*Jour. Indus. and Engin. Chem., 8 (1916), No. 10, pp. 896–899, fig. 1*).—Experimental data are reported by the authors from the Ohio Experiment Station which show that ammonia can be determined by aeration over magnesium oxid.

The Folin tubes were found to be of little value at the rate of air flow (1,080 liters per hour) used in the experiments reported. For complete absorption of the liberated ammonia an absorbing tower in which the air could be completely scrubbed while passing through the absorbent was necessary. A modified tower with which complete absorption of rather large quantities of ammonia was possible in 2.5 hours is described.

The use of considerably smaller quantities of magnesium oxid than are commonly recommended was found to yield as satisfactory results.

It is indicated that a standard method of measuring the rate of aeration should be adopted so that results from various sources may be comparable.

Does vanadium interfere with the determination of phosphorus in soils when the phosphorus is weighed as magnesium pyrophosphate? R. A. Gortner and W. M. Shaw (*Soil Sci., 2 (1916), No. 3, pp. 299–304*).—A series of phosphorus determinations, using soil solutions to which known amounts of vanadium were added, the phosphorus being weighed as pyrophosphate after standing for 24 hours, are reported in detail. In no instance was any appre-

ciable interference by vanadium observed. The titrametric method for phosphorus was also unaffected by the presence of vanadium in amounts far in excess of those usually found in soils.

See also a previous note by Robinson (E. S. R., 34, p. 806).

Examination of a radio-active fertilizer, W. P. JORISSEN (*Chem. Weekbl.*, *13* (*1916*), *No. 39, pp. 1055–1059, figs. 2*).—The author reports the examination of a fertilizer which showed a radium content of 0.14×10^{-10} gm. per gram of dry material.

The apparatus and manipulation of the emanation method for determining radio-activity are described in detail.

The solubility of leucite in sulphurous acid, J. SCHROEDER (*Jour. Indus. and Engin. Chem., 8* (*1916*), *No. 9, pp. 779, 780*).—Solubility tests of leucite of varying degrees of fineness in sulphurous acid indicate that the potash may be readily dissolved from the leucite rocks by this acid. The materials used varied in fineness from 0.5 to less than 0.1 mm., and the potash dissolved on the basis of K_2O present in the samples varied from 41.7 to 76.4 per cent.

The possibility of the industrial application of this procedure for the extraction of potash by using the smelter gases in the western part of the United States near regions where the leucite occurs naturally is indicated.

Report of the seventh convention of Dutch food chemists (*Chem. Weekbl.*, *13* (*1916*), *No. 36, pp. 974–1009, fig. 1; Pharm. Weekbl., 53* (*1916*), *No. 36, pp. 1193–1230, fig. 1*).—This report contains a short address by the chairman, a short report on the hydrogenation of oils, and analytical notes and data on methods of food analysis as recommended by the Dutch Chemical Society.

Improved apparatus for use in making acidity determinations of corn, H. J. BESLEY and G. H. BASTON (*U. S. Dept. Agr., Office Sec. Circ. 68* (*1916*), *pp. 4, fig. 1*).—A modified procedure of the method by the authors, previously noted (E. S. R., 31, p. 525), is described. The procedure consists essentially of extraction with 80 per cent alcohol for 30 minutes with the use of an electric mixer, dilution of 25 cc. of the filtrate with 75 cc. of water, and titration with 1/100-normal alkali.

It is indicated that, while there is some variation in the results of acidity determinations by different methods, the electric mixer will extract from the corn in 30 minutes an amount of acid which, for all practical purposes, is comparable to the amount extracted in 80 per cent alcohol after 18 hours digestion.

An improved method for the detection of arachidic acid, R. H. KERR (*Jour. Indus. and Engin. Chem., 8* (*1916*), *No. 10, p. 904*).—A method for which the advantages of greater convenience, a lessening of the number of operations, a reduction of the amount of attention required, and the avoidance of the use of ether are claimed over the Renard method as adopted by the Association of Official Agricultural Chemists (E. S. R., 20, p. 512) is described.

The procedure consists of saponifying the oil with alcoholic potash and neutralizing excess alkali with acetic acid after saponification is complete. Fifty cc. of 5 per cent magnesium acetate is then added, and the mixture heated to boiling, cooled, and placed in a refrigerator at a temperature of from 10 to 15° C. until the next day. The solution is filtered, the precipitate washed twice with 50 per cent alcohol and three times with distilled water, and returned to the original flask. One hundred cc. of hot distilled water is then poured into the flask and sufficient dilute sulphuric acid added to decompose the magnesium salts. The flask and contents are heated until the acids form a clear layer, the flask is cooled, the acid solution decanted, and 100 cc. of hot water added to wash the fatty acids. After cooling, the solidified cake of acids is freed as far

as possible from water by draining, dissolved in 100 cc. of 90 per cent alcohol, and the arachidic acid separated by crystallization.

The procedure has been found capable of detecting 5 per cent of peanut oil in olive oil, cotton-seed oil, soy bean oil, and corn oil. No attempt, however, has been made to apply it for quantitative purposes.

The determination of citric acid in milk, R. KUNZ (*Arch. Chem. u. Mikros., 8 (1915), No. 4, pp. 129–133*).—The following procedure for the determination of citric acid in milk, based on the test described by Stahre,[1] is described:

Fifty cc. of milk is treated with 10 cc. of dilute sulphuric acid (1:1) in a 200-cc. volumetric flask, and thoroughly shaken. Two cc. of a 40 per cent potassium bromid solution and 20 cc. of a solution of phosphotungstic acid are then added and the mixture made up to volume with distilled water. After thorough mixing the precipitate is separated by filtration, 150 cc. of the perfectly clear filtrate is transferred to an Erlenmeyer flask, 25 cc. of freshly prepared saturated bromin water added, and the mixture then placed for about five minutes on the water bath at a temperature of from 48 to 50° C. Ten cc. of a 5 per cent potassium permanganate solution is then slowly added from a pipette in a continuous stream with constant shaking of the mixture. The pentabrom acetone which is precipitated is filtered and treated as previously described for the determination of citric acid in wine.[2]

A correction for the volume of the protein precipitated in the procedure described for milk is necessary, and was found by the author to be such that 150 cc. of the clear filtrate used was equivalent to 38.2 cc. of the original sample. Analytical data obtained from a number of samples of normal milk examined showed a variation of from 0.1553 to 0.173 gm. of citric acid per 100 cc. of milk.

In two samples of human milk examined, 0.0618 and 0.0439 gm. of citric acid, respectively, were found per 100 cc. of milk.

Comparative determinations of fresh and soured milk indicated that the citric acid gradually disappeared with the aging of the sour milk. This destruction of the acid is deemed to be due rather to microbial action than to the enzyms contained in the milk. An examination of freshly prepared 24-, 48-, and 72-hour-old Bulgarian sour milk (yoghourt) showed no destruction of the citric acid present.

The determination of gum and pectin in filter residues [in the manufacture of sugar], T. VAN DER LINDEN (*Meded. Proefstat. Java-Suikerindus., 6 (1916), No. 7, pp. 205–219*).—After some preliminary experimentation the following modified procedure for pectin determination was evolved:

Twenty gm. of the residue is digested for one-half hour with from 200 to 400 cc. (depending on the nature of the material) of a mixture of alcohol and hydrochloric acid (100 parts 95 per cent alcohol and 20 parts hydrochloric acid, specific gravity 1.09). The mixture is then filtered and washed with warm alcohol, the residue repeatedly extracted with from 300 to 400 cc. of warm water, the extracts evaporated to about 40 cc. on the water bath, and, on cooling, the pectin precipitated with a mixture of 300 cc. of 95 per cent alcohol and 60 cc. of hydrochloric acid, specific gravity 1.09. After several hours the precipitate is filtered through an ashless paper, dried at 105° C., and weighed. The material is then ashed, again weighed, and the difference calculated as pectin.

A study of the sirup precipitate in white sugar manufacture, C. E. COATES and L. C. SLATER (*Jour. Indus. and Engin. Chem., 8 (1916), No. 9, pp. 789–792*).—The authors have examined the sirup precipitate obtained from two factories, in one of which phosphoric acid was used in the clarification and the other in which no acid was used.

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[1] Ztschr. Analyt. Chem., 36 (1897), No. 3, p. 195.

[2] Arch. Chem. u. Mikros., 7 (1914), No. 6, pp. 285–299.

The precipitate from the factory using no phosphoric acid consisted essentially of 40 per cent organic matter, 30 per cent silica, and the remainder of calcium phosphate, copper, iron, and aluminum salts. The other precipitate contained 25 per cent organic matter, 30 per cent silica, and 25 per cent calcium phosphate, the remainder being copper, iron, and aluminum salts.

Detailed analytical data are submitted.

The composition of sound and frozen lemons with special reference to the effect of slow thawing on frozen lemons, H. S. BAILEY and C. P. WILSON (*Jour. Indus. and Engin. Chem., 8 (1916), No. 10, pp. 902–904*).—Analytical data obtained from samples of fruit damaged in southern California by the freeze of January 6, 1913, show that lemons that remained on the trees after being frozen retained less juice and considerably less acid than the fruit picked immediately after being frozen and stored at a temperature of from 45 to 50° F. A rapid decrease in specific gravity due to the loss of juice and acid and the formation of thick, puffy skins, dried-up cells, and hollow centers was observed in the fruit left on the trees. Somewhat less juice was retained by the fruit picked immediately after being frozen and stored under ordinary packing-house conditions than by unfrozen fruit. The composition was practically the same, however, and in weight and appearance the slowly thawed lemons compared well with normal fruit.

See also a previous note by Young (E. S. R., 34, p. 502).

The production of sweet-orange oil and a new machine for peeling citrus fruits (*U. S. Dept. Agr. Bul. 399 (1916), pp. 19, figs. 10*).—This bulletin consists of two parts.

I. *Possibility of the commercial production of sweet-orange oil from waste oranges*, S. C. Hood and G. A. Russell (pp. 1–12).—The investigation reported shows that the extraction of sweet-orange oil is a commercial possibility in the United States. A good quality of oil was produced by steam distillation in vacuo, but an excellent quality and a larger quantity of oil was secured by pressing the pulped peel from culls, drops, and inferior grades of fruit. An average yield of from 4 to 5 oz. of oil was obtained from 100 lbs. of fruit, the cost for this extraction being about 15 cts. The net returns from a standard field box are deemed to be from 32 to 44 cts.

II. *A detailed description of a new machine for peeling citrus fruits*, S. C. Hood (pp. 13–19).—The construction and manipulation of a machine which, manipulated by one man, can remove the peel from 2 tons of oranges or from 3.5 tons of grapefruit in one hour is described in detail. The peel comes from the machine in a finely divided condition suitable for the extraction of the oil, and the peeled fruit is in a condition suitable for use in the manufacture of various fruit products. The machine, as described, can be used for oranges or lemons, and with slight modifications also for limes or grapefruit.

The effect of curing on the aromatic constituents of vanilla beans, F. RABAK (*Jour. Indus. and Engin. Chem., 8 (1916), No. 9, pp. 815–821, figs. 3*).—Experimental data reported indicate that the curing process as commercially applied at present to vanilla beans is unnecessarily long and extended, requiring on the average several months for the transformation.

Laboratory experiments have demonstrated that the beans can be cured in a much shorter time by means of a less tedious process. The simplification of the process is rather to the advantage than to the detriment of the aromatic constituents of the cured beans. It is suggested that, in order to produce uniformity in the composition of the beans and thereby to insure more uniform extracts, the beans should be imported green and cured.

"While the amount of vanillin in the beans was not increased appreciably, as compared with commercial beans, it may be stated with assurance that the

beans cured in the laboratory were in most cases superior in vanilla resins and coloring matter. This is significant since vanilla resins and coloring matter are considered important adjuncts to the quality of vanilla beans. The superior flavor of the extracts prepared from the laboratory cured beans may therefore be ascribed to the resinous constituents. A considerable proportion of the vanilla resins are left unextracted when the menstruum is less than 65 per cent alcoholic strength."

The curing of the green beans at room temperature, with or without previous treatment with water at 90° C. for a short period of time produced beans of the best quality, as judged by the flavoring extracts prepared from the samples.

Notes on the production of oil of citronella, A. W. K. de Jong (*Teysmannia, 27 (1916), No. 4–5, pp. 246–252 figs. 2*).—These pages contain notes on the preparation of the grass for distillation, the distillation process, and the separation of the oil and water in the crude product.

Analytical data submitted show an increase of 44 per cent in yield of oil from grass which had been dried for ten days over that yielded by fresh material. Cutting the grass in lengths of from 3 to 5 cm. (1.2 to 2 in.) was also found to increase the yield. The residue from the distillation on analysis showed moisture 15.8 and nitrogen 2 per cent. Its value as a fertilizing material is indicated.

The use of bark for paper specialties, O. Kress (*Jour. Indus. and Engin. Chem., 8 (1916), No. 10, pp. 883–886*).—Experiments on the use of hemlock and oak bark used in conjunction with rag stock for the manufacture of roofing felts, etc., the use of hemlock and oak bark with unbleached sulphite pulp for a hanging paper, and the use of spruce and balsam for wall boards are described. Suggestions as to further possible uses of such stock are made and the economic importance indicated.

METEOROLOGY.

The effect of climate and soil upon agriculture, R. R. Spafford (*Univ. [Nebr.] Studies, 16 (1916), No. 1–2, pp. 91–113, figs. 26*).—This article is based primarily upon farm-management studies in 16 counties in Nebraska, but also takes into consideration certain general observations extending over a wider area of the surrounding region.

From the studies in Nebraska it is concluded that the most important natural factors determining the character of farm business in that State are moisture and soil texture. " In general cultivated plant growth per acre varies quite in harmony with the growth of native vegetation," and this is determined largely by the rainfall. There is a " rapid change from favorable to adverse conditions after passing the 24-in. line of rainfall. The number of acres required to pasture a horse or cow may be used as a rough measure of this change. To provide five months' pasture for a mature animal in western Nebraska requires about four times the number of acres necessary in eastern Nebraska. From this fact alone it is not out of reason to infer that a decrease in the effective value of moisture reduces the available pasture growth from 1 to about one-fourth." In one case studied the effective value of moisture is such that the total usable pasture growth is only about one-fourth that in another, and it was found that the size of the farm in the first case was at least four times that in the second.

These conclusions, though based largely on Nebraska data, are not considered local in bearing. " Moisture problems from southern Texas to the head of the Mississippi River are closely related. To the south they are influenced by high temperature, while to the north they are modified by low temperature. From the head of the Mississippi northwest into Saskatchewan and Alberta a lobe of favorable summer temperature determines, to a large extent, the boundaries of

the Canadian agricultural area recently opened. In the southern part of this lobe the problems of low temperature are more commonly blended with problems of low rainfall than is true farther north. . . . The distribution of native vegetation relative to these lines is very marked. . . . The natural factors which give such striking characteristics to the distribution of native vegetation give equally striking characteristics to the distribution of people and the organization of farm business."

The probable growing season, W. G. REED (*U. S. Mo. Weather Rev., 44 (1916), No. 9, pp. 509–512, fig. 1*).—From a study of data relating to the length of the frostless period from 1872 to 1914 at Keokuk, Iowa, it is concluded that in general "the chance of killing frost falls to 10 per cent between 10 and 30 days after the average date of the last killing frost in spring; in the fall the corresponding difference is about the same. In general any station has a dispersion in spring similar to that in fall."

Weather insurance, W. G. REED (*U. S. Mo. Weather Rev., 44 (1916), No. 10, pp. 575–580*).—In continuation of previous discussions bearing on this subject (E. S. R., 35, p. 617), the author maintains that the cost of losses from unfavorable weather conditions should be carried as an annual charge against the farm business. From a study of extensive data relating to the frequency distributions of injurious spring and fall frosts in Kansas and Ohio he concludes that sufficient data are now available "to enable determinations of the chance of frost at any time to be made for nearly all the agricultural regions of the United States. Although other phenomena do not show the same frequency distributions as critical frost dates, the distributions for many of these phenomena have been partially investigated and the mathematical studies already completed indicate that the chance of any weather condition at all can be determined with more or less accuracy. Therefore practicable insurance against any unfavorable weather depends solely upon the determination of the hazard and a sufficient number of properly distributed risks."

Condensed meteorological reports, C. C. GEORGESON (*Alaska Stas. Rpt. 1915, pp. 93–100*).—Tabular monthly summaries are given of observations on temperature, precipitation, and condition of the weather at 25 stations in different parts of Alaska during 1915.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and J. S. SIMS (*Massachusetts Sta. Met. Buls. 335–336 (1916), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during November and December, 1916, are presented. The general character of the weather for November is briefly discussed, and the December bulletin gives a summary for the year. The principal data in this summary are as follows:

Pressure, reduced to freezing and sea level (inches).—Maximum, 30.64, January 8; minimum, 28.76, February 25; mean, 30.006. *Air temperature*, in ground shelter (degrees F.).—Maximum, 95.5, August 22; Minimum, —16, February 15. *Humidity*.—Mean dewpoint, 38.4; mean relative humidity, 80.3. *Precipitation*.—Total rainfall or melted snow, 45.61; number of days on which 0.01 in. or more rain or melted snow fell, 126; total snowfall, 59.5 in. *Weather*.—Total cloudiness recorded by sun thermometer, 2,418 hours, or 53 per cent; number of clear days, 121. *Bright sunshine*.—Number of hours recorded, 2,036, or 47 per cent. *Wind*.—Prevailing direction, west; total movement, 52,450 miles; maximum daily movement, 519 miles, February 28; minimum daily movement, 0 miles, December 4; maximum pressure per square foot, 25 lbs., January 23, west. *Dates of frost*.—Last, May 19; first, September 17. *Dates of snow*.—Last, April 14; first, November 15.

Monthly Weather Review (*U. S. Mo. Weather Rev., 44 (1916), Nos. 9, pp. 499–545, pls. 12, figs. 7; 10, pp. 547–610, pls. 13, figs. 22*).—In addition to weather forecasts, river and flood observations, and seismological reports for September and October, 1916; lists of additions to the Weather Bureau Library and of recent papers on meteorology and seismology; notes on the weather of the months; solar and sky radiation measurements at Washington, D. C., during September and October, 1916; condensed climatological summaries; and the usual climatological tables and charts, these numbers contain the following articles:

No. 9.—Shading Effect of Wire Insect Cages (illus.), by H. H. Kimball (see p. 455); Circumstantial Arc with a Black Band, by H. H. Martin; Atmospheric Electrical Variations at Sunset and Sunrise, by E. H. Nichols; Ionization of the Upper Atmosphere, by W. F. G. Swann; Ground Rainbows, by A. E. Heath; Temperature and Radiation of the Sun, by F. Biscoe; Solar Corpuscular Rays, by K. Birkeland; Aurora of September 30, 1916, by H. C. Hunter and D. Manning; The Probable Growing Season (illus.), by W. G. Reed (see p. 418); Certain Characteristics of the Winds at Mount Tamalpais, Cal. (illus.), by H. H. Wright; Rainfall on Days with Air Temperature Below the Freezing Point, by S. Takayama; Newtonian Constant of Gravitation as Affected by Temperature, by P. E. Shaw; Gravitation and Temperature, by J. L[armor]; Ice Crystallizations from Aqueous Solutions, by R. Hartmann; The Kata Thermometer as a Measure of the Effect of Atmospheric Conditions on Bodily Comfort, by C. E. A. Winslow; Ball Lightning on Puy de Dôme, by E. Mathias; Central Observatory of Mexico Removed; Cleveland Abbe, 1838–1916; Henrik Mohn, 1835–1916; Hurricane Tracks, 1912–1915, by R. H. Weightman; and Further Data on the Tropical Storm of July 12–22, 1916, by H. C. Frankenfield.

No. 10.—Additional Note on the High Haze of July and August, 1916, by H. H. Kimball; Elementary Notes on Least Squares, the Theory of Statistics and Correlation, for Meteorology and Agriculture (illus.), by C. F. Marvin (see below); Injury to Vegetation Resulting from Climatic Conditions, by G. E. Stone (see p. 431); Lassen Peak's Name; An Eruption of Lassen Peak (illus.), by A. H. Palmer; A New Method for Determining "*g*," the Acceleration Due to Gravity, by H. Bell; Indian Summer and Plimsoll's Mark (illus.), by W. G. Reed; Weather Insurance, by W. G. Reed (see p. 418); What is a "Geocol"? and A Cyclone in Perspective (illus.).

[Observations on aerology] (*U. S. Mo. Weather Rev., Sup. 3 (1916), pp. 67, pls. 8, figs. 11*).—This supplement contains the following articles: Sounding Balloon Ascensions at Fort Omaha, Nebr., May 8, 1915; Meteorological Observations on Board the U. S. Coast Guard Cutter Seneca, April to July, 1915; The Drexel Aerological Station; and Free-air Data at Drexel Aerological Station, October, November, and December, 1915.

Elementary notes on least squares, the theory of statistics and correlation, for meteorology and agriculture, C. F. Marvin (*U. S. Mo. Weather Rev., 44 (1916), No. 10, pp. 551–569, figs. 18*).—"An effort has been made in this paper to outline in a general way the essential principles of the methods of least squares and the theories of statistics and correlation, with reference to their application in the analysis and presentation of climatic data and their utilization in the solution of problems of agricultural meterology. While a considerable knowledge of mathematics is essential to a complete mastery of all the methods, processes, and relations, nevertheless an elementary knowledge and a little study are sufficient to enable anyone to carry out the relatively simple routine and systematized calculations that are necessary to bring out all the

facts. Examples of these computations have been shown with considerable and seemingly all necessary fullness."

A bibliography of the more recent literature on this subject is given.

SOILS—FERTILIZERS.

Soil survey of the Ukiah area, California, E. B. Watson and R. L. Pendleton (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 53, pls. 5, figs. 2, map 1*).—This survey, made in cooperation with the California Experiment Station, and issued December 16, 1916, deals with the soils of an area of 193,920 acres in southeastern Mendocino County, Cal., which includes several arable valleys and a part of the Coast Range Mountains. The drainage of the hills is well established, and that of the valley floors, with some few exceptions, is generally complete.

"The soils of the Ukiah area fall into three general groups [as follows]: (1) Residual soils, (2) soils derived from old valley-filling material, and (3) soils derived from recent alluvial deposits." Including rough mountainous land and river wash, 20 soil types of ten series are mapped, of which rough mountainous land covers 67.7 per cent and Pinole gravelly loam 11.4 per cent of the area.

Soil survey of Washington County, Georgia, R. A. Winston, J. H. Agee, J. A. Kerr, and M. E. Carr (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 39, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, and issued December 15, 1916, deals with the soils of an area of 428,160 acres in the Coastal Plain region of east central Georgia, the topography of which ranges from undulating to rolling. The uplands are naturally well-drained, while the first bottom lands are usually low, flat, and poorly drained.

The soils are of sedimentary origin and range from loose incoherent sands to fairly heavy silty clays. Including meadow, 20 soil types of 10 series are mapped, of which the Norfolk sandy loam, Orangeburg sandy loam, Norfolk sand, meadow, and Ruston sandy loam cover 21.4, 17.7, 13.5, 11.1, and 10.2 per cent of the area, respectively.

Soil survey of Wilkes County, Georgia, D. D. Long (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 35, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture, and issued December 18, 1916, deals with the soils of a well-drained area of 306,560 acres in the Piedmont plateau province in northeastern Georgia. The topography in general is gently rolling.

Most of the soils of the county are of residual origin and are heavy, belonging to the silty clay loam, clay loam, and clay classes. A considerable area of soils of sandy loam, fine sandy loam, and loam texture also occurs. Including meadow, 18 soil types of five series are mapped, of which the Cecil clay loam and sandy loam cover 38.5 and 18.5 per cent of the area, respectively.

Soil survey of Coahoma County, Mississippi, F. Z. Hutton et al. (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 29, fig. 1, map 1*).—This survey, made in cooperation with the State of Mississippi and issued December 19, 1916, deals with the soils of an area of 357,120 acres in the Mississippi Delta region in northwestern Mississippi. In spite of the numerous streams, large areas in the county have poor drainage.

The soils consist entirely of alluvial deposits, and the more important are divided into two groups, (1) having heavy clay subsoils, and (2) having light-textured subsoils. Including meadow, overwash, and excavated land, 12 soil types of three series are mapped, of which the Sharkey clay, Sharkey silty clay

loam, and the Sarpy very fine sandy loam cover 52, 14.3, and 10.4 per cent of the area, respectively.

Soil survey of Dickey County, North Dakota, T. M. BUSHNELL ET AL. (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 56, pls. 2, fig. 1, map 1*).—This survey, made in cooperation with the North Dakota Experiment Station and issued November 24, 1916, deals with the soils of an area of 730,880 acres in southern North Dakota which physiographically comprises "(1) an old, sandy lake bed; (2) level, treeless prairie; and (3) a high, rolling plain. . . . On the plateau and in the Lake Dakota basin regional drainage has not been established. The remainder of the county is imperfectly drained."

The soils of the county are derived from glacial drift. Including rough broken land, 28 soil types of 10 series are mapped, of which the Barnes loam and silt loam cover 31.5 and 18.8 per cent of the area, respectively. "The Barnes series predominates east of the Missouri Plateau, and comprises much of the best farming land in the county."

The loess soils of the Nebraska portion of the transition region.—V, The water-soluble constituents, F. W. UPSON, J. W. CALVIN, and G. H. BROTHER (*Soil Sci., 2 (1916), No. 4, pp. 377–386, fig. 1*).—An investigation conducted at the Nebraska Experiment Station on the water-soluble material in soils dealt with in previous papers by Alway et al. (E. S. R., 35, pp. 809, 810) is reported.

It was found that "in general the water-soluble material in the loess soils of the Nebraska portion of the transition region is low. The average total water-soluble material is quite uniformly distributed as to area, the inorganic material increases with the aridity, whereas the volatile material decreases with increasing aridity. The water-soluble bicarbonates decrease from west to east and follow the total carbonates in this respect. The water-soluble chlorids and sulphates as well as calcium and magnesium are quite uniformly distributed and follow the distribution of the total amounts of these constituents in these same soils. The water-soluble potassium is highest in the western areas and lowest in the eastern areas. In the extreme eastern area it decreases from the surface downward, whereas in the western area the reverse is true. In this respect it follows the citric-acid-soluble potash and not the total potash, which is quite uniformly distributed. The water-soluble phosphates show no very regular distribution."

Factors affecting the evaporation of moisture from the soil, F. S. HARRIS and J. S. ROBINSON (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 10, pp. 439–461, figs. 17*).—The studies reported in this article were made at the Utah Experiment Station with loam, sand, clay, and muck, mostly in small tin plates and copper vessels 8 in. in diameter and 4 in. deep, but also in Petri dishes, long galvanized iron tanks, and deep cylindrical galvanized cans. An attempt was made to eliminate the factor of capillarity and to confine the study entirely to evaporation and various factors affecting it, including the initial quantity of soil moisture, humidity of the air, wind velocity, sunshine, temperature, size of soil particles, mulches, compacting the soil, method of applying water, and the presence of soluble salts. The experimental methods are described in detail.

It was found that "evaporation of moisture increases with the initial quantity in the soil. The increase is not so great with the higher percentages as with the lower, and there seem to be a number of critical points where the rate of loss changes rapidly. The rate of evaporation from a moist soil is very rapidly decreased as the humidity of the air is increased. Air currents greatly increase evaporation; but after about a certain wind velocity is reached the rate of evaporation is only slightly increased by increasing the wind velocity.

For the sizes investigated, evaporation was higher from the finer soil particles than from the coarser when both are completely saturated.

"Reducing the intensity of sunshine greatly reduces the rate of evaporation. Slight changes in temperature have a marked effect on evaporation. A thin mulch, if kept dry, is effective in reducing evaporation. Dry mulches, composed of fine particles, seem to be less effective than if composed of coarser particles. Compacting the surface of the soil increases evaporation. Dissolved salts in high concentrations reduce the evaporation of moisture from soils."

A list of 21 references to literature bearing on the subject is given.

Keep our hillsides from washing, A. R. Whitson and T. J. Dunnewald (*Wisconsin Sta. Bul. 272 (1916), pp. 18, figs. 14*).—This bulletin deals with the extent and bad results of erosion on Wisconsin soils and describes preventive measures applicable to conditions of the State, including tillage, alternation of crops on sidehills, use of horizontal channels and terraces, protection of ravines and watercourses with stones and grass roots, gradual removal of trees from wooded hillsides, and the use of sidehill land for pasture.

Protozoa, as affecting bacterial activities in the soil, S. A. Waksman (*Soil Sci., 2 (1916), No. 4, pp. 363–376*).—Experiments conducted at the New Jersey Experiment Stations on the interaction between protozoa and bacteria in a clay soil and a light loam soil are reported.

It was found that the presence of protozoa seemed to check the bacterial numbers, which were found to be smaller in the soils where the protozoa were present than in the corresponding soils where they were absent. The ammonifying efficiency of the soil did not follow the changes in bacterial numbers.

Heating the soil at 65° C. for five hours destroyed the protozoa in all instances but one and greatly reduced the bacterial numbers; but when the proper amount of moisture was added and the soils were allowed to incubate for 30 days, the bacterial numbers increased to almost three times those of the check. There was a corresponding increase in ammonia production in the soil.

The action for 48 hours of 4 per cent toluene, which was then allowed to evaporate for 48 hours, killed the ciliates, but not the flagellates; this treatment also reduced the bacterial numbers, but they at once increased after the toluene was allowed to evaporate. The action of toluene and heat was greatest upon soils having a high content of organic matter, whether the protozoa were active or not.

The light loam soils kept out of doors gave higher bacterial numbers and higher ammonifying efficiency than those kept under laboratory temperatures, and the latter gave higher numbers and ammonifying efficiency than those kept at 30°. The soils with optimum moisture content gave in the main higher bacterial numbers and ammonifying efficiency than those of higher moisture content.

Nitrification in semiarid soils, I, W. P. Kelley (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 10, pp. 417–437*).—Previous investigations on this subject are briefly reviewed and laboratory studies at the California citrus substation of the relation of the concentration of nitrogenous materials and the period of incubation to the rate of nitrification are reported.

The results of the investigations showed that the amounts of nitrate formed from dried blood, bone meal, or ammonium sulphate during 4 weeks' incubation varied greatly with the amount of nitrogenous materials employed. When 1 per cent of dried blood was used (the proportion commonly employed in conventional nitrification studies) the nitrifying activity was found to be feeble or even negative in certain soils in which 1 per cent of bone meal and from 0.2 to 0.3 per cent of ammonium sulphate underwent active nitrification. When

low concentrations of dried blood such as are used in the field were employed, active nitrification took place in every case, and when equal amounts of nitrogen were added it was found that the yield of nitrate was quite similar whether the nitrate had been derived from dried blood, bone meal, or ammonium sulphate. High concentrations of bone meal furnishing amounts of nitrogen equivalent to that supplied by 1 per cent of dried blood inhibited nitrification in the same way as the dried blood. It was found that the inability to nitrify 1 per cent of dried blood was not confined to any one type of soil nor to soils low in organic matter.

"The effects produced by the addition of alkali salts varied greatly when different concentrations of nitrogenous materials were employed. In a given soil a concentration of 0.05 per cent of sodium carbonate was distinctly toxic to the nitrification of 1 per cent of dried blood, while as high a concentration as 0.4 per cent produced no effects on the nitrification of 0.1 per cent of dried blood. Likewise, 0.1 per cent of sodium carbonate was toxic to the nitrification of 0.15 per cent of ammonium sulphate, and markedly stimulating when 0.0625 per cent of ammonium sulphate was used. Similar statements may be made with regard to the effects of sodium sulphate.

"The results also show that widely different conclusions may be drawn from laboratory experiments when different periods of incubation are used.

"Nitrites were found to accumulate in large amounts where excessive amounts of nitrogenous materials were employed. In some cases the nitrite content greatly exceeded the nitrate content after an incubation period of several weeks. Likewise, the addition of alkali salts may suppress nitrate formation, while at the same time permitting nitrite formation to proceed actively."

The author concludes as a result of these investigations "that the methods now employed by many students of nitrification, in which high concentrations of nitrogenous materials are added and the nitrate determined at a fixed interval of time, are not only unsatisfactory, but that the results thus obtained are likely to be more misleading than informing." He therefore recommends that the activities of nitrifying organisms be studied in an environment as nearly similar to that of the field as possible.

A bibliography of literature bearing on the subject is given.

The nitric nitrogen content of the country rock: A contribution regarding the origin of niter spots in certain western soils, R. STEWART and W. PETERSON (*Soil Sci., 2 (1916), No. 4, pp. 345–361, pl. 1*).—Experiments conducted at the Utah Experiment Station with samples of Utah and Arizona soils are reported, from which results were obtained similar to those obtained in previous work (E. S. R., 32, p. 28) with Utah, Colorado, and Wyoming soils.

It is concluded that "the nitrates of the niter spots of the cultivated soils are derived from the preexisting accumulations occurring in the adjacent country rock and transported by the movement of underground water, brought to the surface by exposure of the rock outcrop, and there deposited by the evaporation of the water. The brown color of the niter spots is due to the solvent and decomposing action of the nitrates on the old organic compounds of the soil, the source of which, like the nitrate, is in the shale and sandstone of the area, which is coal and oil bearing."

It is further pointed out that "characteristic niter spots may be produced artificially in the laboratory with a rich greenhouse soil and an excess of sodium nitrate. They are produced equally as well in soil rendered sterile by treatment with a saturated solution of mercuric chlorid or 5 per cent solution of carbolic acid."

On the distribution of phosphorus in a vertical section of bluegrass soil, A. M. Peter (*Soil Sci.*, *2* (*1916*), *No. 4*, *pp. 387–393*, *figs. 2*).—The chief object of this paper, prepared at the Kentucky Experiment Station, is to draw attention to the peculiar distribution of the phosphate in vertical soil sections taken from the experiment station farm at Lexington and to point out that it corresponds strikingly to the distribution of phosphate in the phosphatic limestone beds of the vicinity. It increased from 0.72 per cent at a depth of 1 ft. to 7.8 per cent at a depth of 6 ft. and thereafter decreased, being 2.02 per cent at a depth of 7 ft.

Nature of the sulphur in moorland soils injurious to plant growth and subterranean structures, W. Thörner (*Ztschr. Angew. Chem.*, *29* (*1916*), *pp. 233–236*; *abs. in Jour. Soc. Chem. Indus.*, *35* (*1916*), *No. 15*, *p. 855*; *Chem. Abs.*, *10* (*1916*), *No. 20*, *p. 2606*).—The so-called reactive sulphur in moor soils, which is injurious to both plant growth and cement in underground foundations, was found to occur not only as pyrites but also in the free state and in organic combination. Its destructive action is ascribed to the production of sulphuric acid by atmospheric oxidation in the presence of moisture. Finely divided sulphur mixed with moist sand or peat on a filter underwent slow oxidation as the water evaporated, and similar conditions are assumed to exist in peaty land containing sulphur on exposure to the atmosphere. An energetic oxidation of finely divided sulphur in aqueous suspension was observed during the electrolysis of the water.

Field tests of fertilizer action on soil aldehydes, J. J. Skinner and C. F. Noll (*Jour. Amer. Soc. Agron.*, *8* (*1916*), *No. 5*, *pp. 273–298*, *pls. 5*, *fig. 1*).—In an extension of work previously reported (E. S. R., 31, p. 620; 32, p. 619), experiments conducted under a cooperative agreement beween the U. S. Department of Agriculture and the Pennsylvania Experiment Station are reported. The purpose was to study the effects of vanillin and salicylic aldehyde on an acid silty clay loam soil at Arlington, Va., and a productive loam soil at the Pennsylvania Station, and the influence of lime and fertilizers on the action of these compounds.

It was found in a two years' field test that vanillin and salicylic aldehyde were harmful to cowpeas in the silty clay loam soil. The harmful effect of vanillin was lessened by sodium nitrate and that of salicylic aldehyde by acid phosphate. The effects of both vanillin and salicylic aldehyde were overcome by liming the soil. These field results are in harmony with the effect of fertilizer salts on the behavior of these compounds in water culture solution.

Vanillin and salicylic aldehyde were found in the silty clay loam soil several months after they were applied and after the end of the crop season. On the plats fertilized with sodium nitrate the vanillin had been changed or destroyed and did not remain as such to have its effect on the crop. Neither vanillin nor salicylic aldehyde was found to remain in the limed soil. The oxidizing power of the Arlington soil was checked by both vanillin and salicylic aldehyde, and this lessened oxidation was increased by fertilizers and by lime.

Vanillin and salicylic aldehyde had only a slight harmful effect on the productive loam soil. Again the harmfulness of vanillin was ameliorated by sodium nitrate and that of salicylic aldehyde by acid phosphate, and on limed soil the aldehyde compounds had no, or only slight, harmful effects. None of the added aldehydes remained in the soil in any of the plats at the end of the growing season. This is taken to indicate "that organic substances of this nature do not persist in this soil and consequently could have little or no effect on crop growth. This experiment demonstrates that such organic substances as aldehydes can exist in one soil and have their effect on growth,

while in another soil they are destroyed by oxidation or other life processes of the soil and do not remain to have an influence on soil productivity."

Soil fertility (*North Dakota Sta. Rpt. 1916, pp. 4, 5*).—A comparison of rotted stable manure with fresh manure and a combination of fresh manure and steamed bone meal gave results confirming those reported in Bulletin 100 (E. S. R., 28, p. 338).

"Four years' data from the milling of the wheats from lands treated with rotted manure, with fresh manure, with combination of fresh manure and steamed bone meal, and without treatment of any character, do not show striking differences that could be attributed to the use of manures. Cost data for the trial indicate that potassium and phosphorus fertilizers can not as yet be profitably used on the black clay soil."

Plat experiments comparing steamed bone meal, acid phosphate, and raw rock phosphate, in which stable manure and crop residues were also added to the soil, showed that on the basis of four-year averages "the commercially fertilized plats have not given a larger gross income than the plats on which stable manure was used. If the cost of the phosphorus fertilizer is deducted from the total income received from crops, a less return was obtained than from the manured plats. The income derived from the various treatments was nearly uniform. No form of phosphorus yielded markedly superior returns in this trial. Comparatively, acid phosphate made a slightly better showing than steamed bone meal or rock phosphate."

The use of fertilizers to increase crop production, E. B. Stookey (*Washington Sta., West. Wash. Sta. Mo. Bul., 4 (1916), No. 9, pp. 5–9, figs. 2*).—This is a brief note based on experience at the substation on the use of fertilizers and manure and especially on the value of manure as compared to other fertilizers. Experiments with potatoes, kale, mangels, and corn on muck, sandy loam, and shot clay soils showed that in all cases manure alone at the rate of 15 tons per acre produced greater increases in yield than sodium nitrate, superphosphate, potassium sulphate, ground lime rock, gypsum, and a complete fertilizer applied at respective rates of 100, 200, 200, 4,480, 200, and 450 lbs. per acre.

Improvement of hill and peaty pastures (*Univ. Col. N. Wales, Bangor, Dept. Agr. [Pub.] 8 (1915), pp. 2–6*).—Experiments on the treatment of poor pasture on hilly loam soil and on acid and neutral peat soils are reported. Seven ¼-acre plats were used, the treatment per acre being as follows: No manure, 1,000 lbs. of basic slag, 1,000 lbs. of ground Gafsa phosphate, 600 lbs. of superphosphate, 600 lbs. of superphosphate and 1 ton of ground lime, 1 ton of ground lime, and 3,600 lbs. of ground limestone. Each plat received in addition to the treatment mentioned, 150 lbs. of potassium sulphate or 600 lbs. of kainit.

The results indicated that basic slag is likely to produce at least as good a result as any other manure or mixture of manures on these soils. Gafsa phosphate (raw mineral phosphate) produced almost as good an effect as basic slag on acid peat soils. In no case was a return given by potash manure at all commensurate with its cost, the effect produced being negligible in almost every case. Lime and ground limestone had practically no effect, although in many cases the soil was acid.

The necessity for guano in national agriculture (*Las Necesidades de Guano de la Agricultura Nacional. Lima: Compañia Admin. Guano, 1916, pp. 432, pls. 85*).—This report deals with Peruvian agriculture with special reference to the use of guano as a fertilizer.

Factors affecting the absorption and distribution of ammonia applied to soils, R. C. Cook (*Soil Sci., 2 (1916), No. 4, pp. 305–344, figs. 7*).—Experiments

conducted at Rutgers College with typical New Jersey soils, including sand, sandy loam, loam, silt loam, and clay soils, on the absorption and distribution of ammonia applied to soils and on factors influencing the same are reported. Fifty gm. of soil was shaken for one minute with 200 cc. of a 1/100-normal ammonium sulphate solution and then allowed to stand, after which the ammonia was distilled off from a filtered portion.

It was found that New Jersey soils presented a wide range of absorptive capacity for ammonia, the smallest absorption being observed in the sand soil and the largest in the sandy loam soil. The presence of calcium oxid in soils seemed to exert a greater influence on absorption than any other factor, first increasing and then decidedly decreasing it. In general, mechanical and chemical composition, hygroscopicity, etc., all had some effect on absorption. To a certain extent, the absorption of ammonia followed the percentage of combined iron and alumina, calcium oxid and carbon dioxid, as well as the organic matter and physical properties of the soil. The presence of colloids and conditions which favor them increased the absorptive power of the soil, while the presence of potash or acid phosphate, either alone or in combination, reduced it.

The distribution of applied ammonia in soils was also quite variable and seemed to be a function of the absorption. In light soils the ammonia quickly found its way into the deeper layers unless there was a supply of CaO present; in heavier soils most of the ammonia was held in the surface 3 or 4 in. A slightly alkaline reaction was beneficial to the conservation of ammonia. Calcium carbonate had little effect upon the distribution of ammonia in soils, while the addition of potash or acid phosphate tended to lower the mean distribution. The ammonia remained nearer the surface of the soil the greater the absorptive capacity. Everything else being equal, ammonium sulphate should be applied shallower in light than in heavy soils."

A list of 35 references to literature bearing on the subject is appended.

Investigation and valuation of crude calcium cyanamid, P. Liechti and E. Truninger (*Chem. Ztg., 40 (1916), pp. 365, 366; abs. in Jour. Soc. Chem. Indus., 35 (1916), No. 11, p. 647*).—A chemical method for determining the nitrogen content of calcium cyanamid is described.

In six specimens of calcium cyanamid a maximum cyanamid-nitrogen content of 0.5 per cent was found, whereas the nitrogen present as dicyandiamid ran to more than 7 per cent. As it was thought that the dicyandiamid can act as a plant poison under certain conditions, pot experiments on wheat were made to compare the action of these abnormal specimens with that of the normal fertilizer. These showed that the former were distinctly injurious to the yield of grain and to a lesser extent to the yield of straw.

During a 3-months' storage of calcium cyanamid in an atmosphere saturated with moisture, the original cyanamid present was almost completely converted into dicyandiamid. On the other hand, no such conversion occurred when the air was kept dry; one sample was preserved in a wooden box for eight years without any deterioration taking place.

The determination of the nitrogen present as cyanamid and as dicyandiamid is considered at least as important as the determination of total nitrogen.

Effect of varying amounts of water upon the decomposition of crude calcium cyanamid and the formation of dicyandiamid, G. Hager and J. Kern (*Ztschr. Angew. Chem., 29 (1916), pp. 221–223; abs. in Jour. Soc. Chem. Indus., 35 (1916), No. 15, pp. 856, 857; Chem. Abs., 10 (1916), No. 20, pp. 2608, 2609*).—Quantities of crude calcium cyanamid of 100 gm. each were treated separately with 5, 10, 15, 25, and 50 gm. of water and inclosed in air-tight glass vessels. After five and seven months the material was analyzed. The fertilizer used

contained total nitrogen 18.62 per cent, of which 17.73 was water-soluble, cyanamid nitrogen 16.75 per cent, nitrogen as dicyandiamid 0.5 per cent, as ammonia 0.24 per cent, and as "urea" nitrogen (i. e., the element left in the filtrate after precipitation of the dicyandiamid) 0.48 per cent.

Seven months' storage without added water caused no perceptible change. With 5 and 10 gm. of water the changes were very small, the dicyandiamid nitrogen rising to 0.61 and 0.87 per cent, respectively. The presence of 15 gm. of water produced more change, the dicyandiamid nitrogen rising to 1.13 per cent and the urea nitrogen to 0.71 per cent. The cyanamid nitrogen fell to 13.61 per cent and the ammonia nitrogen to 0.14 per cent. Very little change took place in the first 10 days when 25 gm. of water was added, but after seven months 2.58 per cent of dicyandiamid was found. With 50 gm. of water profound changes took place and the material set to a hard stone-like mass. After two and one-half and seven months the dicyandiamid nitrogen rose to 7.51 and 9.17 per cent, respectively, the cyanamid nitrogen falling to 2.81 and 0.28 per cent, respectively, in the same periods. It is pointed out that calcium cyanamid should not be stored after it has become wet, but may be used immediately. The use of water to produce it in a granulated form is considered not likely to succeed.

The analyses were performed by Caro's method.

Calcium cyanamid, L. Malpeaux (*Vie Agr. et Rurale, 5 (1915), No. 2, pp. 28–30*).—This is a review of experimental work by the author and others on the use of calcium cyanamid as a fertilizer, showing that when used under proper conditions it gives results comparable with those obtained with sodium nitrate and ammonium sulphate.

It is concluded that for the practical use of cyanamid it should be applied and incorporated in the soil at the time the soil is prepared for seeding. It should be used in the fall for winter cereals, avoiding spreading when mixing except on pasture. Mixtures of cyanamid with superphosphate should be avoided.

Two references to literature bearing on the subject are appended.

Phosphate fertilizers for Hawaiian soils, and their availability, W. T. McGeorge (*Hawaii Sta. Bul. 41 (1916), pp. 45, pls. 4*).—Studies of the solubility of the phosphoric acid naturally occurring in certain Hawaiian soils, as well as of the behavior of various phosphates when applied to them, are reported.

Pot experiments with millet, cowpeas, buckwheat, radishes, and turnips on sandy volcanic soil, ferruginous red-clay soil, and a red soil with less clay, to determine the availability of different phosphates when applied in amounts equivalent to 0.007, 0.014, 0.021, and 0.028 per cent phosphoric acid, indicated that the soluble phosphates in frequent light applications are the most effective on Hawaiian soils, especially the red clays. Iron and aluminum phosphates were found to be readily available sources of phosphoric acid in Hawaiian soils, the former more so in the first crop in the absence of added lime. In sand cultures these phosphates surpassed clay and rock phosphate.

"In most locations it is poor economy to add bone meal or other difficultly soluble phosphates to Hawaiian soils. . . . In wet districts (uplands) phosphate rock, bone meal, basic slag, or reverted phosphate should be very effective, more especially so if applied to highly organic soils or used in systems of diversified agriculture where they may be incorporated with green manure crops." Basic slag was more effective as a source of phosphoric acid than phosphate rock, bone meal, or reverted phosphate. Lime applied with phosphates temporarily assisted the plants in assimilating phosphoric acid, but it soon lost its effectiveness unless present in excessive amounts.

Studies of the solubility of phosphoric acid in potted soil, of phosphates after addition to soil, and of phosphoric acid occurring naturally in Hawaiian soils, as indicated by treatment with several reagents, indicated that "hydrochloric acid of official strength does not dissolve all of the phosphoric acid of Hawaiian soils. To determine the total phosphate content, it is necessary to fuse the soil with sodium carbonate. Fifth-normal nitric acid has very little solvent action upon the phosphate in the soils, indicating the absence of appreciable quantities of calcium phosphate. One per cent citric acid has a much stronger solvent action than fifth-normal nitric acid. Of the weaker solvents, 1 per cent sodium hydroxid is the strongest, due to its action on the iron and aluminum phosphates. The fertilizer (phosphate) requirement of the soil is not measured by solubility in water or fifth-normal nitric acid, but it may be indicated by the solubility in citric acid. The solubility of a phosphate before it is added to a soil can not be used as a criterion of its solubility after addition, but it may indicate its availability. The fixation of a soluble phosphate by the soil may be influenced by the basicity of the soil. Availability as determined with solvents does not agree in full with that indicated by plant growth."

A description of a modification of the official method used in determining the phosphoric-acid content of Hawaiian soils by reason of the high titanium content is appended. See also a previous note (E. S. R., 35, p. 503).

Phosphate fertilizers, B. SUTHERLAND (*Proc. Roy. Soc. Victoria, n. ser., 28 (1916), No. 2, pp. 208–210*).—Field experiments on 1/200-acre plats with early and late wheat and oats are reported. The purpose was to compare sodium orthophosphate, sodium pyrophosphate, and trimetaphosphate with each other and with superphosphate when used in amounts equivalent in phosphoric-acid content to 100 lbs. of superposphate per acre.

It was found that metaphosphate gave in all cases a better crop than superphosphate, but with some plats the difference was practically negligible. Pyrophosphate was in every case less satisfactory than superphosphate. Metaphosphate applied as a top-dressing in spring did very little good. Apparently the value lay in the initial start to the very young plant. In the case of brown oats, which grew rapidly, the advantage of using metaphosphate was very marked.

The citric acid solubility of the phosphate in Thomas slag, P. KROLL (*Ztschr. Angew. Chem., 29 (1916), I, pp. 199, 200; abs. in Jour. Chem. Soc. [London], 110 (1916), No. 645, II, p. 389; Chem. Abs., 10 (1916), No. 20, p. 2608*).—It was found that the addition of sand in the converter raised the citrate solubility of the phosphoric acid in Thomas slag on the average by about 1 per cent. The amount of soluble phosphate seemed to have a tendency to remain constant for each particular type of slag and to be more or less independent of the total amount of phosphate present. This constant was about 18.5 per cent for sand slag and 17.3 per cent for normal slag.

The conservation of phosphate rock in the United States, W. C. PHALEN (*Bul. Amer. Inst. Mining Engin., No. 119 (1916), pp. 1901–1934, figs. 6*).—This report deals with the production, exportation, and conservation of phosphate rock in the United States, describes substitutes used therefor, and describes domestic and foreign deposits, especially those of Florida and Tennessee and of Africa and the southern Pacific Ocean.

The salt and alkali industry, G. MARTIN, S. SMITH, and F. MILSOM (*London: Crosby Lockwood & Son, 1916, pp. VIII+100, pl. 1, figs. 36*).—In addition to chapters on the manufacture of common salt, hydrochloric acid, sodium sulphate, and sodium carbonate, two chapters are included on the Stassfurt salt industry and on potassium salts in general.

"Loog as;" or the ash of the alkali bush, A. Stead (*So. African Jour. Sci., 12 (1916), No. 11, pp. 540–542*).—Analyses of the ash of *Mesembrianthemum junceum* showed a content of water soluble potash of 22.2 per cent or potassium carbonate 32.59 per cent. This plant, it is stated, grows luxuriantly in many of the Karoo districts of South Africa. It is considered an excellent source of potash for acid soils and is estimated to be of about twice the normal manurial value of kainit.

Chemical analysis of ash (*Alaska Stas. Rpt. 1915, p. 25*).—An analysis by E. Fulmer of one sample of volcanic ash showed a potash content of 2.48, calcium oxid 3.8, and total phosphoric acid 0.36 per cent.

Outline of the relation of the use of lime to the improvement of the soil, E. O. Fippin (*N. Y. State Col. Agr., Cornell Univ. Ext. Bul. 5 (1916), pp. 16, figs. 2*).—This is a popular discussion of soil acidity and its causes, the tolerance of different crops for acidity and alkalinity in soils, and different kinds of lime and their use and benefits in acid soils with special reference to New York conditions.

It is stated that "in the hill sections of New York from southern Wyoming, Ontario, and Madison counties southward, and throughout the Hudson valley region with the exception of a few small areas, . . . the lack of lime is one of the most important limiting factors in larger crop production. In the remaining cultivated sections of the State the use of some lime is generally beneficial. The part of the State where the soil is best supplied with lime is a strip of land extending southward for a distance of from 10 to 20 miles from a line passing through Utica, Syracuse, Rochester, and Niagara Falls."

Analyses of commercial fertilizers, fertilizer supplies, and home mixtures, C. S. Cathcart et al. (*New Jersey Stas. Bul. 297 (1916), pp. 3–43*).—This bulletin contains the results of actual and guarantied analyses of 635 samples of fertilizers and fertilizing materials collected for inspection in New Jersey during 1916.

AGRICULTURAL BOTANY.

A textbook of botany for colleges, W. F. Ganong (*New York: The Macmillan Co., 1916, pp. XI+401, figs. 276*).—This book is designed as an introductory course in botany as part of a scheme in general education, and not for the preparation of professional botanists. In conformity with this idea, attention is given to the larger and more obvious aspects of plant activity, special emphasis being placed on the interpretation of principles and the connection of botanical science with knowledge in general and with man's relations to plants. As the author states, "the book may be described as an attempt to present and interpret the humanly important aspects of plant nature in the light of our modern scienific knowledge." It is intended to be used in conjunction with laboratory work to connect the facts there discovered with the science as a whole.

Some recent researches in plant physiology, W. R. G. Atkins (*London: Whittaker & Co., 1916, pp. XI+328, figs. 27*).—The object of this book is to present to senior students and investigators the results of recent work in some of the branches of plant physiology which are attracting attention. Matter already current in textbooks has been almost entirely excluded. The choice of material by the author was influenced to a considerable degree by his work at the School of Botany, Trinity College, Dublin. The main subjects treated are carbohydrates, pectic substances, osmotic pressure, permeability of cells, functions of the wood, and oxidases. Extensive bibliographies of these different subjects are included in the publication.

The principles of plant teratology, W. C. Worsdell (*London: Ray Soc., 1915, vol. 1, pp. XXIV+270, pls. 25, figs. 61*).—This book is designed to describe in a scientific manner abnormalities in the plant kingdom and to determine why the structures are present and how they came to be produced. The author considers the study of teratological data of importance in determining various morphological problems, and the work is offered as a contribution to the evolutionary origin of plant organs. The present volume treats of the teratology of fungi, bryophytes, etc., and of the root, stem, and leaves of higher plants. A volume dealing with the flower is contemplated.

Morphology of the flowers of Zea mays, P. Weatherwax (*Bul. Torrey Bot. Club, 43 (1916), No. 3, pp. 127–144, pls. 2, figs. 4*).—The author reports the result of a study carried on for about two years on the morphological characters of the flowers in six subspecies of *Z. mays.*

Maize is normally monœcious. Both male and female spikelets are two-flowered. The silk is structurally and functionally a stigma. Pollination is effected by gravity or wind. Though cross-pollination is more usually the method, self-pollination occurs to some extent. In flowers of either sex, the rudimentary organs of the opposite sex may be replaced by organs of normal appearance which are regularly functional in some varieties of corn.

Xerophotic movements in leaves, F. C. Gates (*Bot. Gaz., 61 (1916), No. 5, pp. 399–407, figs. 8; abs. in Science, n. ser., 43 (1916), No. 1106, pp. 360, 361*).—An account is given of observation and experimentation on xerophotic response as manifested in the upward turning or curling movements of leaf blades resulting from the drying effect produced through the agency of light, particularly direct sunlight. The lessened turgor of the cells of the upper side allows a movement in the direction from which the desiccating agency comes, the resulting position decreasing the amount of radiant energy received and thus reducing the harmful action of intense sunlight upon chlorophyll and transpiration.

In the localized type of xerophotic response, the difference in turgidity is confined to a limited area, such as the pulvini of the leaflets. In the more generalized type, the difference is between the upper and the lower part of the blade. The first type is said to have been noted in all species of legumes studied and to have been observed in some other families. The second type has been observed in the monocotyledonous families Poaceæ, Araceæ, Marantaceæ, and Zingiberaceæ. While in nature the response was produced by direct stimulation from the sun, it was produced also by the action of the chemical desiccating agents alcohol and xylol on *Gliricidia sepium* and *Ipomœa pes-capræ.* The amount of movement which took place under suitable conditions at any season varied with different conditions between 45 and 70° above the horizontal.

The daily movements of leguminous leaflets, F. C. Gates (*Plant World, 19 (1916), No. 2, pp. 42–45, figs. 2*).—In giving a daily program of the movements of leguminous leaflets under the influence of direct sunlight, as above noted, two classes may be considered. One, exemplified by *Gliricidia sepium*, is that of plants with a drooping night position. The other, exemplified by *Leucæna glauca*, is that in which the night position is above instead of below the horizontal. The changes during 24 hours are discussed, with mention of a certain amount of irregularity observable about the time of the full moon.

The warm water treatment of the seeds of certain herbaceous and green manure plants that are difficult to germinate, J. A. Honing (*Meded. Deli-Proefstat. Medan, 10 (1916), No. 1, pp. 16–23*).—The results are given of some experiments in the germination of Albizzia, Mimosa, Pithecolobium, and Crotalaria seeds previously immersed in warm water at different temperatures and for different lengths of time.

The best germination of Albizzia seed was secured when the seed was soaked for at least three hours in water at a temperature of about 60° C. Mimosa seed gave the best results when soaked in water of from 60 to 70°, and Pithecolobium seed when the temperature of the water was from 70 to 75°. Soaking in warm water was disadvantageous to Crotalaria seed and soaking in cold water was not of much advantage.

The physiology and technique of forcing growth in woody plants, F. La Marca (*Staz. Sper. Agr. Ital. 48 (1915), No. 10–11, pp. 772–782*).—Tests as detailed with various woody plants in regard to the effects of removing bud scales, puncturing the bud with a fine needle, injecting water or compounds of copper, iron, nickel, etc., have led to the conclusion that the forcing effects observed are due almost wholly to the disturbance consequent upon wounding or to the consequent release from pressure in the bud.

Injury to vegetation resulting from climatic conditions, G. E. Stone (*Jour. N. Y. Bot. Gard., 17 (1916), No. 202, pp. 173–179; U. S. Mo. Weather Rev., 44 (1916), No. 10, pp. 569, 570*).—The general conditions which result in winter injury to plants are briefly stated, and more complete accounts are given of the character and causes of frost cracks, sun scald, sun scorch, and bronzing.

The formation of parenchyma wood following winter injury to the cambium, A. J. Mix (*Phytopathology, 6 (1916), No. 3, pp. 279–283, figs. 3*).—The author describes the formation of parenchyma following winter injury to apple trees.

Effect of sodium salts in water cultures on the absorption of plant food by wheat seedlings, J. F. Breazeale (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 9, pp. 407–416, figs. 8*).—The results are given of experiments undertaken to determine the extent to which the presence of the various sodium salts commonly found in alkali soils affects the absorption of plant food elements by wheat seedlings. Sodium chlorid, sulphate, and carbonate, in concentrations ranging from 50 to 1,000 parts per million, were employed in connection with a standard nutrient solution, and wheat plants grown on floating disks were used to test the effects of the different salts.

All of the sodium salts tested, when added to the nutrient solutions, even in the highest concentrations mentioned, did not measurably affect the nitrogen absorbed from the culture solutions, but sodium chlorid decreased the absorption of potash slightly, though it did not affect that of phosphoric acid. Sodium sulphate in concentrations of 1,000 parts per million depressed the absorption of potash and phosphoric acid to approximately 70 per cent of that of the control cultures. Sodium carbonate in the same concentration reduced the absorption of potash to 20 per cent of the control and that of phosphoric acid to 30 per cent. The depressing effect of sodium carbonate was also observed in concentrations as low as 100 parts per million.

The relative effect of sodium sulphate and sodium chlorid in depressing the absorption of potash is said to be directionally the same as the relative hydrolysis resulting from the reaction of the two salts with the calcium carbonate present in the culture solution. This is believed to suggest that the observed effects in the case of sodium sulphate and sodium chlorid may be due in part to the accumulative action of the slight amounts of sodium carbonate formed in this reaction.

Assimilation of iron by rice from certain nutrient solutions, P. L. Gile and J. O. Carrero (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 12, pp. 503–528*).—The results are given of a series of investigations carried on at the Porto Rico Experiment Station to determine whether the reaction of soils has any effect on the assimilation of iron by rice. Rice was grown in acid, neutral,

and alkaline solutions with different forms and quantities of iron and the effect of the reaction of the solution on the assimilation of iron was noted.

When judged by the growth of plants, ferrous sulphate, ferric citrate, and ferric tartrate afforded sufficient iron when used in proper quantities in acid and neutral solutions. Ferric chlorid proved an inferior source of iron and dialyzed iron utterly inadequate. Ferric tartrate was the only form of iron which furnished sufficient amounts of that element for the nutrition of plants in alkaline solutions.

Plants grown in acid solutions contained the highest percentages of iron. Those grown in neutral solutions contained higher percentages of iron than those grown in alkaline solutions when some forms of iron were used, but they contained equal percentages when other forms were used. The percentages of nitrogen, phosphoric acid, lime, magnesia, and carbon-free ash in plants grown in six different solutions did not vary appreciably when compared with the iron content.

It appears that rice was not found to be particularly sensitive to the reaction of the solution except as the reaction influenced the availability of the iron. This is believed to substantiate previous work in showing that lime-induced chlorosis is caused by a lack of iron and in indicating that the only acton of carbonate of lime in inducing chlorosis lies in its diminishing the availability of iron.

The influence of manganese on plants, G. Masoni (*Staz. Sper. Agr. Ital., 48 (1915), No. 10–11, pp. 822–838; abs. in Chem. Abs., 10 (1916), No. 19, p. 2495; Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 3, pp. 345, 346*).—Reporting a further study (E. S. R., 26, p. 226) of maize as affected by manganese compounds, the author states that manganese in very small or larger proportions has shown some favorable influence on the growth of plants, but that this influence is not specific or direct.

The nutrition of green plants by means of organic substances, C. Ravenna (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 25 (1916), I, No. 9, pp. 649–655, figs. 3*).—The author, describing experiments carried out with sterile cultures of maize in aqueous solutions of glucose, states that the leaves produced starch even in the absence of carbon dioxid but only in the light, the portion of the solar spectrum most influential in this regard being that showing the greatest activity in regard to chlorophyll. The plants rooted in sugar solution but deprived of carbon dioxid and of oxygen did not form starch even in sunlight.

The cause of the disappearance of cumarin, vanillin, pyridin, and quinolin in the soil, W. J. Robbins (*Science, n. ser., 44 (1916), No. 1147, pp. 894, 895*).—A preliminary report is given of a biological study made to determine the reason for the disappearance of the toxic activity of cumarin, vanillin, pyridin, and quinolin in soils.

Flasks containing soils to which the above compounds had been added were inoculated with infusions from normal soils and incubated for two months, after which wheat was planted in the soils. The growth of the wheat plants in the inoculated soil showed that the toxic properties of the compounds had largely disappeared, while their effect was still very evident in bottles containing sterile soil. This is believed to indicate that the disappearance of the compounds is due to biological causes. From the bottles or pots, three species of bacteria were isolated, one of which was found to use pyridin as a source of nitrogen, while one used vanillin and another cumarin as a source of carbon. No organism has yet been found to act on quinolin.

As a result of the author's investigations, it is considered that the enormous increase in the number of organisms in the treated pots and the disappearance

of the four substances in the soils depend on the fact that the compounds serve as sources of food for different species of bacteria.

Studies in permeability.—III, The absorption of acids by plant tissue, Mildred Hind (*Ann. Bot. [London], 30 (1916), No. 118, pp. 223–238, figs. 11*).—This is a continuation of the series of studies begun by Stiles and Jörgensen (E. S. R., 35, p. 224). The present author has attempted to ascertain how far the rapid absorption of hydrogen ions, as previously noted in regard to hydrochloric acid in aqueous solution, is charactertistic of acids in general. Several acids were used in this work, which was carried out with potato tubers and with living plants of *Vicia faba*. The part played by proteins was also studied.

It was found that the hydrogen ions of all the acids examined are rapidly absorbed by plant tissue from dilute solutions. The anion largely determines the effect of the acid on the cell, the fatty acids contrasting strongly with the mineral acids in this respect. Proteins may also influence acid absorption by plants. Lecithin was not shown to be concerned in such absorption.

Production of root hairs in water, Ethel M. Bardell (*Univ. Wash. Pubs. Bot., 1 (1915), No. 1, pp. 9*).—The author, outlining experimental work on root hair development in water in the case of sunflower, maize, pea, bean, wheat, oats, and Tradescantia, states that elongation of root cells is greater in air than in water. The number of root hairs tends to decrease with increase of strength of the fractional solutions of normal potassium nitrate, this being ascribed to a decrease of absorption and consequent diminution of turgor.

The conclusions of Snow (E. S. R., 17, p. 849) have been confirmed by the employment of other methods. It is stated that light conditions do not affect root hair production. Curves and swellings favor the production of root hairs, which are more abundant on the concave side of curves. Usually cortical cells in hairy portions are shorter than those in hairless portions, also the average length of hairy cells grown in air, water, or fractional solutions of normal potassium nitrate is usually less than that of hairless epidermal cells and of cortical cells.

A method for maintaining a constant volume of nutrient solutions, O. L. Clark (*Science, n. ser., 44 (1916), No. 1146, pp. 868, 869, fig. 1*).—A method for the automatic renewal of nutrient solutions is briefly described.

Proposed classification of the genus Rollinia, with descriptions of several new species, W. E. Safford (*Jour. Wash. Acad. Sci., 6 (1916), No. 12, pp. 370–384, figs. 3*).—In an attempt to correct what are considered errors of classification, the author has made a revision of available material which is considered to belong to the genus Rollinia, from which certain forms have been previously set apart by him under the generic name Rolliniopsis (E. S. R., 36, p. 220).

Desmopsis, a new genus of Annonaceæ, W. E. Safford (*Bul. Torrey Bot. Club, 43 (1916), No. 4, pp. 183–193, pls. 3, fig. 1*).—Technical descriptions are given of species to which the new generic name Desmopsis is given, under the specific names *D. panamensis*, *D. galeottiana*, *D. maxonii*, *D. bibracteata*, and *D. oerstedii*.

Pleiospermium, a new genus related to Citrus, from India, Ceylon, and Java, W. T. Swingle (*Jour. Wash. Acad. Sci., 6 (1916), No. 13, pp. 426–431*).—A new genus, Pleiospermium, is described to include the species formerly known as *Limonia alata* and *L. dubia*. These species, which are technically described, are suggested as suitable stocks for Citrus, the former on the drier soils, the latter on limestone hills. It is thought that, on account of its primitive and polymorphic nature, *P. dubium* may hybridize with some true citrus species.

The origin of new varieties of Nephrolepis by orthogenetic saltation.—I, Progressive variations, R. C. Benedict (*Bul. Torrey Bot. Club, 43 (1916), No. 5, pp. 207–234, pls. 6*).—This is a study of the varying progeny of the so-called Boston fern, *N. exaltata bostoniensis*, known to have produced in about 15 years at least 60 horticultural forms which have been named. The great majority at least have originated as bud sports. Most of the descendants have tended away from the original variety, some back toward it, but few, if any, reaching the original form or the form of the immediate parent.

The variations, which are produced and preserved in large numbers, partly owing to the extensive production and care of the plant, are classified as progressive and regressive or reversive in regard to the parent form, the variation coefficient of the former being very low as compared with that of the latter. The variations are all discrete or discontinuous, the differences paralleling those existing among many wild species of ferns and of flowering plants, except that the horticultural forms do not possess adaptability to natural conditions, decreased vigor of growth usually characterizing departure from type. The origins or causes of variation have not been rendered apparent, but they appear to proceed as if from internal stimulation under conditions apparently serving, not as causes but as means of preserving the variants.

The mutual influence of genotypical factors, Tine Tammes (*Rec. Trav. Bot. Néerland., 13 (1916), No. 1, pp. 44–62*).—Reporting the results of further investigations (E. S. R., 34, p. 629) on *Linum usitatissimum* carried through several generations, the author states that the plants not only possess factors apparently independent of each other, but that in many cases the visible manifestation of a factor depends upon the presence or absence of several other factors. Probably no factor is entirely independent of other factors. The relations of certain factors in case of flax varieties are discussed.

Dry grassland of a high mountain park in northern Colorado, F. Ramaley (*Plant World, 19 (1916), No. 9, pp. 249–270, figs. 6*).—Results of an ecological study of a dry grassland park in northern Colorado at an elevation of about 9,000 ft. are given. The vegetation is described as low growing, consisting largely of grasses and sedges, with many profusely flowering perennials. Five seasonal periods are recognized, and a series of six societies is noted, corresponding to historical stages from bare soil to the ultimate grassland of the park. The effect of climate, soil, and evaporation and the importance of rodents, etc., are briefly discussed.

Fungus flora of Texas soils, F. C. Werkenthin (*Phytopathology, 6 (1916), No. 3, pp. 241–253, fig. 1*).—A report is given of an investigation in which a study was made of the fungi in three kinds of soil, one of which was from a cotton field, another from a greenhouse, and the third from the university campus, where the soil had not been disturbed for at least 20 years. The frequency and distribution of the fungi are indicated.

The author states that to a depth of 4 in. the fungi were fairly uniformly distributed, while below 4 in. no viable fungus spores were found. No marked variation in species of fungi was observed that could be attributed to cultivated or virgin soil. The climate is believed to have a great influence on the flora of soils, species of Aspergillus being the dominant soil fungi of the South. Species of Penicillium frequently found in northern soils are said to be rare in Texas soils, and the Mucors are not so abundant in southern soils. Pathogenic fungi, especially species of Fusarium, were found to live in the soil as saprophytes throughout the winter.

Relative importance of fungi and bacteria in soil, H. J. Conn (*Science, n. ser., 44 (1916), No. 1146, pp. 857, 858*).—The author reports having tested several soils by Waksman's method (E. S. R., 35, p. 820), using, however, only

about 10 mg. of soil in an attempt to find whether fungi are as important as bacteria in soil.

While bacteria were found abundantly, mold hyphæ were present only where the soil contained considerable organic matter. Where organic matter was not added to the soil development was slow, and this is considered to suggest that molds are relatively insignificant in the soil. In the author's experiments nearly every kind of soil micro-organism except molds was found, and it is thought doubtful whether fungus mycelium is present to any significant extent in soil.

FIELD CROPS.

Report of [field crops] work at Fairbanks Station, J. W. Neal (*Alaska Stas. Rpt. 1915, pp. 42–50, 52–54, pls. 4*).—This reports the continuation of field crop work previously noted (E. S. R., 33, p. 631).

The frost-free period at this station extended over an interval of 109 days, spring seeding being begun 18 days earlier than in 1914. Four varieties of spring wheat were tested, with the Russian variety known as H. G. giving the most promise for the future. Marquis proved to be of good quality and the Russian spring wheat No. 36 was early in maturing. Three varieties of spring barley were tested, with hull-less barley No. 19851 from the station 1914 crop giving the best results. This barley has never failed to mature a full crop when seeded reasonably early. Sixty-day, Canadian, and Finnish Black oats were tested, with the latter giving the highest yields. All varieties gave heavy yields, but Finnish Black did not yield so heavily as heretofore. Gesselberg spring rye was tested but was slow in maturing.

Twelve varieties of winter wheat and four of winter rye were seeded in the fall of 1914. Eight of the wheat varieties winterkilled, while the four remaining varieties wintered a fair stand, but were killed by the spring freezing and thawing. This is the first experience of the kind at the station. All the rye wintered a fair stand, but were badly damaged by the spring freezing and thawing. These experiments have been continued and in the fall of 1915 each plat was covered with a heavy well-matted growth.

All alfalfa varieties except a few plants of the Siberian strains winterkilled. Notes are given on the following varieties that made a fair growth: North Swedish, Hansen Cherno, Hansen Cossack, and Hansen Semipalatinsk. New seedings were made of Grimm alfalfa No. 162, Pioneer Strain, Disco No. 28, and Grimm Coin Holder (Glenheim strain). These varieties all made a heavy top growth and the early plants produced many well-filled seed pods. Later seedings were made of Orenburg common alfalfa, hardy Grimm, and Glenheim White Blossom. No seed pods were set. In these seedings the seed was sown in deep furrows and lightly covered and packed to aid early germination.

Red clover winterkilled, but a considerable quantity of seed practically matured from the spring seeding, although the weather was too wet to cure the crop.

One hundred and fifty bu. of Petrowski turnips were set out in the spring, but owing to drought only 260 lbs. of seed were saved.

Fifteen potato varieties were tested and the yields listed in tabular form. Considerable loss has been sustained from the corky scab and potato rust which the formaldehyde treatment did not seem to check.

Report of [field crops] work at Kodiak Live Stock and Breeding Station, M. S. Snodgrass (*Alaska Stas. Rpt. 1915, pp. 71–76, 76–79, pls. 2*).—The continuation of field crop work previously noted (E. S. R., 33, p. 632) is reported for 1915.

The winter of 1914–15 is reported as being an open one, permitting early plowing and seeding. The plowing at Kodiak was sufficiently deep to mix thoroughly the soil and volcanic ash, resulting in a friable sandy loam which warms up quickly in the spring. At Kalsin Bay it was impossible to plow to sufficient depth to obtain a proper mixture. The work of restoring vegetation on the deep volcanic ash was also continued by seeding 23 acres of mixed grass with the oats seeded for hay.

Cow kale was grown with good success at Kodiak. Brief notes are also given on oats for hay and silage, barley, rutabagas, turnips, and mangels. The four best potato varieties produced in 1914 were again tested. Burpee Superior and Clark Alaska Seedling gave the highest yield, but Irish Cobbler and Extra Early Ohio were more uniform and superior in quality.

About 135 tons of silage was secured at Kalsin Bay composed of mixed bluetop, fireweed, and beach grass. At Kodiak 18 tons of oats and 16 tons of beach grass were put up as silage.

Report of [field crops] work at Rampart Station, G. W. GASSER (*Alaska Stas. Rpt. 1915, pp. 54–67, 68, 69, pls. 6*).—Field crops work previously noted (E. S. R., 33, p. 632) is continued for 1915.

Meteorological data are submitted for the last 10 years at the Rampart Station. The frost-free period for 1915 was 107 days, and the winter of 1914–15 is reported as exceptionally mild.

Notes are given on the clearing and preparation of new land and on the production of grain hay. The 1-acre field of brome grass seeded in 1910 continues to give a perfect stand although the crop was very light in 1915.

Of the 20 varieties of alfalfa tested 4 have survived as perfectly hardy. These 4 are yellow-flowered and are *Medicago falcata*, Omsk, Obb, and Gobi Desert. Grimm, Sand Lucern, Mongolian, and Cherno alfalfas, all purple flowered, were considerably winterkilled. In the Grimm plat a number of plants showing marked variation from the standard were observed and the seed gathered separately for further testing. Special attention is being given to yellow-flowered varieties of alfalfa, and particularly *M. falcata*. About 2,000 plants of this variety were transplanted in the spring and set 30 in. apart each way. Abundant growth resulted, together with considerable seed production. The coarse-stalked plants seemed to bear more seed than the fine-stalked ones, and a number of such plants were marked and the seed kept separate. A small plat of Omsk alfalfa has ripened considerable seed, but Gobi Desert and Obb, although as hardy as Omsk, have never ripened seed and, furthermore, are of procumbent growth. *Trifolium lupinaster* is conspicuous for its hardiness, producing stalks about 16 in. long and always ripening its seed, but as a hay crop it is a failure. *Vicia cracca* produced a good growth after coming through the winter in excellent shape. A yellow-flowered vetch was found in this plat and the seed gathered separately.

Hybridization work was continued with winter rye, barley, and spring wheat. Kharkov winter wheat was crossed with Sandomirka, an earlier Russian variety which apparently possesses great hardiness. Of the new hybrids grown for the first time only one or two of each give any promise for the future, but all will be seeded again so that single-head selections can be made from the second generation. Single-head selection is being rigidly adhered to.

In addition to the hybrids, 12 varieties of spring wheat were grown. Chogot, Irkutsk, No. 306, hybrid 24 A 1, hybrid 24 A 2, and H. G. ripened 100 per cent seed by August 20. Certain of these varieties possesses objectionable features, but their earliness renders them valuable for hybridization. The Sandomirka winter wheat wintered 95 per cent, the Kharkov next at 20 per cent.

Three varieties of spring rye were tested, with Irkutsk maturing the earliest of the three. None was so early as the earliest winter rye, nor were the heads so well filled. Ten varieties of winter rye were tested, and all were hardy provided they were protected by a covering of snow, but there was a difference of 12 days in the ripening. Irkutsk, Giant French, Amber, No. 959, Monster, and Station No. 195 all ripened by August 12.

A number of oat varieties are being tested, with Finnish Black, Norwegian, and South Dakota No. 637 ripening the earliest (95 days). Hybrids of Copperfield and Toholampi have come true and were a day earlier than the above-named varieties.

Pamir barley ripened earliest, in 79 days. Three new varieties were tested.

Notes are also given on variety tests with buckwheat, flax, and broad beans, and cultural notes on hemp.

Twenty-nine new potatoe varieties from the Sitka Station were tested for the first time. Tests were also made to determine the value of seed pieces cut to a single eye, but contradictory results were obtained.

[Field crop] notes at Sitka Station, J. P. Anderson (*Alaska Stas. Rpt. 1915, pp. 32, 33, fig. 1*).—Seventy-seven varieties of potatoes tested at the Sitka Station are listed, giving the yields for 1914 and 1915. Owing to the dying of the tops of some early varieties in August and the differences in the fertility of the soil, results for the two years are not comparable. The quality is reported as good in all but a few varieties. Four additional varieties were grown for the first time in 1915.

Results of experiments, 1915, A. E. V. Richardson (*Jour. Dept. Agr. Victoria, 14 (1916), Nos. 3, pp. 147–152; 5, pp. 288–295, figs. 5*).—In rotation tests, the most profitable increases were obtained in a rotation of wheat and hay with forage crops, such as peas and barley, thus eliminating fallowing.

In fertilizer tests the best results were obtained from the use of 1 cwt. of acid phosphate per acre. Lime and nitrogenous fertilizers have not been profitable. High yields were obtained from all manurial treatments. Manure with acid phosphate gave the highest yields.

Wheat sown at the rate of 60 lbs. per acre the first week in May gave the best results, and Yandilla King and Dart Imperial proved to be the highest yielding wheat varieties. In green manuring tests wheat gave higher yields after fallowing than after green manure crops, either when the latter were plowed under or fed off to sheep.

Pasture crops in the prairie provinces, T. J. Harrison and J. Bracken (*Agr. Gaz. Canada, 3 (1916), No. 5, pp. 419–430, figs. 8*).—Pasture conditions in the provinces of Manitoba and Saskatchewan are discussed in some detail. Various mixtures of grasses and other forage crops are recommended for perennial, biennial, or annual pastures for each section.

Germination experiments with grasses and legumes, A. Burgerstein, (*Ztschr. Landw. Versuchsw. Österr., 18 (1915), No. 8–9, pp. 559–570*).—The results of studies to determine the relative growth values of different grasses and legumes, when the seeds are planted at different depths, are discussed, and work of a similar nature conducted as pot and field experiments by the author is described.

In the pot experiments maize seeds, as determined by the depth of planting from which the coleoptile reached the surface of the soil, showed the greatest vigor of growth, being followed in decreasing order by oats, barley, wheat, and rye. Among the leguminous seeds studied peas and lentils showed a marked vigor of growth, as in a loose, humus, or sandy soil, at a seed depth of 40 cm. (about 15.6 in.), 40 per cent of the peas and 50 per cent of the lentils were capable of reaching the soil surface.

Striking differences in vigor of growth were exhibited by seeds of *Phaseolus multiflorus* and *P. vulgaris*. Planted at a depth of 20 cm., 97 per cent of the seed of *P. multiflorus* and only 12 per cent of the seed of *P. vulgaris* produced plants. When planted at a depth of 25 cm., 88 per cent of the seed of *P. multiflorus* reached the surface of the soil, while not a single seedling of *P. vulgaris* appeared.

Sprouting seeds of Helianthus and Cucurbita showed less vigor in pushing through the soil than those of peas, lentils, vetch, and *P. multiflorus*. Thickly planted seeds of Zea maize and *P. vulgaris*, at depths of from 15 to 25 cm., came up quicker and in greater numbers than the same number of seeds planted on twice the area. In humus soil the difference in the vigor of growth of seeds of *Vicia sativa* was insignificant, in sandy soil plainly perceptible, and in clay soil quite marked. Lentil seeds, which possess a relatively high vigor of growth, exhibited practically no difference when planted 25 cm. deep.

In the field tests with seeds planted at depths of 15, 20, and 25 cm., the percentage of successful germination and growth was as follows: Lentils, 53, 42, and 16; peas, 50, 44, and 20; *V. faba*, 68, 40, and 20; *P. multiflorus*, 36, 8, and 0; and *P. vulgaris*, 2, 0, and 0, respectively. In a similar test, with the depth of planting at 10 cm., the percentage of seedlings secured from the seeds planted was as follows: Pumpkin, 40; sunflower, 66; oats, 82; barley, 75; and club wheat, 60 per cent.

Crucifers and grasses, with reference to their utilization of soil nitrogen, T. Pfeiffer, W. Simmermacher, and Miss M. Spangenberg (*Fühling's Landw. Ztg., 64 (1915), No. 21–22, pp. 521–534*).—This article, somewhat controversial in nature, reports the results of several series of pot experiments conducted to determine (1) whether the plant food contained in mustard grown in a mixture with grain can be utilized by the grain crop after the mustard has been destroyed by spraying with iron sulphate solution, (2) whether the yield of oats grown alone is as large as or larger than the yield of oats grown mixed with mustard which is destroyed when it begins to bloom, and (3) whether the nitrifying capacity of the soil is changed under the influence of a mixed culture of oats and mustard as compared with oats grown alone. The conclusion drawn from the results secured is that mustard is without effect in each of the relationships studied, and that the assumption of L. Hiltner regarding the value of mustard in mixed culture in relation to the companion crop is not based on adequate evidence.

Grasses with creeping roots.—Advantages and disadvantages, E. Breakwell (*Agr. Gaz. N. S. Wales, 26 (1915), No. 12, pp. 1031–1034, pls. 7*).—This article deals with a discussion of the root systems of Johnson grass (*Sorghum halepense*), couch grass (*Cynodon dactylon*), Rhodes grass (*Chloris gayana*), summer grass (*Panicum sanguinale*), and *Paspalum dilatatum*, a common pasture grass in New South Wales. The advantages of each grass as a pasture grass due to its stoloniferous tendencies and physiological characteristics are discussed and illustrated. The disadvantages when the grasses are encountered in cultivated fields are also discussed, and methods of eradication for each grass are briefly outlined.

[The production of young grass with heavy applications of sulphate of ammonia], H. Neubauer, G. Hillkowitz, and P. Schneider (*Fühling's Landw. Ztg., 64 (1915), No. 21–22, pp. 534–543*).—Experimental data are presented showing the greater production of total and digestible protein from a given area of either high or medium fertility when the grass was cut every 14 days as compared with cutting three times during the season. In connection with the use of 400 kg. of ammonium sulphate per hectare (356 lbs. per acre), it was observed that an increase in grass production took place immediately

after the application, and that this effect had almost entirely disappeared at the end of four weeks. Notes are also given on the cost of fertilizing grass lands, the feeding value of young grass, the artificial curing of grass, and the production of forage on lawns and in parks.

[Chlorin requirement of the buckwheat plant], T. PFEIFFER and W. SIMMERMACHER (*Landw. Vers. Stat., 88 (1916), No. 1-2, pp. 105-120*).—This article reviews work on this subject by a number of investigators and describes a study made by the authors to determine the relation of chlorin to the growth of the buckwheat plant. In view of the results secured it is concluded that while chlorin is a necessary plant food, the chlorin requirement of the buckwheat plant is very small and that the presence in the soil of relatively large quantities of chlorin compounds affects its growth injuriously.

Corn growing under droughty conditions, C. P. HARTLEY and L. L. ZOOK (*U. S. Dept. Agr., Farmers' Bul. 773 (1916), pp. 24, figs. 15*).—This publication deals with corn growing in dry-land regions, although the principles discussed apply wherever corn is produced.

It is pointed out that while corn is not naturally adapted to semiarid regions owing to its heat requirements and peculiar flowering habits, it has been introduced into dry-land agriculture because of its extensive production in other regions and the advantages it presents in rotation with the small grains. The chief essentials of corn growing are given as water, heat, soil fertility, and seed, any one of which may, if lacking, become the limiting factor to production. In the semiarid regions the limiting factor is for the most part either water or heat, and the discussion is based, therefore, on the best means of getting moisture into the soil and retaining it there until the corn crop can make the most efficient use of it. The following points are discussed in some detail from the standpoint of dry-land farming: Preparation of the seed bed, time of planting, methods of planting, and cultivation.

Corn growing under irrigation is briefly discussed, and some of the causes for failures in this practice pointed out. The short growing seasons and extreme differences between day and night temperatures are given as limiting factors encountered, although they may be partly overcome by growing early maturing adapted varieties. Some of the preventable causes for failure are given as overirrigation, too frequent irrigations, too early irrigations, and too little cultivation.

Certain animal and insect enemies of the corn crop are briefly mentioned, together with general control measures. The necessity for good seed and the choice of adapted varieties are discussed.

The practice of pasturing corn to hogs is recommended for semiarid regions, not only because of the labor saved in harvesting the crop but also because the flint and flour varieties may thus be grown.

Some factors influencing yield in maize, H. WENHOLZ (*Agr. Gaz. N. S. Wales, 26 (1915), No. 12, pp. 1023-1029*).—This article deals in a popular way with the meteorological conditions under which maize is produced in New South Wales. The time and method of planting are noted, together with the selection of adapted varieties and good seed. The preservation of seed between seasons is discussed in some detail.

Hulled oats, P. O. OVERGAARD (*Tidsskr. Planteavl, 23 (1916), No. 1, pp. 84-102, fig. 1*).—The results of experiments on the seed value of hulled oats showed that oats hulled in the process of threshing and sown mixed with normal oats are worthless for seeding purposes when soil conditions are unfavorable for germination or when the seed is subject to insect attacks. Under favorable conditions hulled oats in a mixture gave up to 50 per cent of the production of

normal oats. When sown alone and the rate of seeding increased in proportion to the lower germination, as compared with oats in normal condition, hulled oats gave a full yield. Careful hulling by hand did not reduce the seed value, but clipping the oats seemed to be an additional factor in reducing the percentage of germination of the hulled portion of the grain.

Oats from a poorly developed crop and injured in thrashing to the extent of having the hull removed wholly or in part produced in a mixture with normal seed grain only 19 per cent of the yield of the normal seed. A well-developed crop of oats grown on clay soil contained about four times as many hulled kernels as a crop of lower quality produced on sandy soil, other conditions being equal. Running the thresher at a moderate speed appreciably reduced the quantity of hulled kernels in the grain. Examination of the seed samples showed in most cases not over 2 per cent of hulled kernels, and it is thought that as a rule not more than this proportion will be found when the oats have been thrashed with a good machine properly adjusted and operated.

Potato experimental fields, 1915–16, J. T. Ramsay (*Jour. Dept. Agr. Victoria, 14* (*1916*), *No. 2, pp. 107–115, figs. 5*).—This article gives detailed plans of potato experiments being conducted in Victoria. Diagrams are submitted showing the arrangement and treatment of the various plats.

Sweet potato curing in Texas, E. W. Cole (*Texas Dept. Agr. Bul. 49* [*1916*], *pp. 25, figs. 10*).—This is a popular publication on the production and curing of sweet potatoes in Texas. Detailed information is given for the propagation, cultivation, and harvesting of the crop. Two methods of storing the product are discussed—(1) the old-fashioned pit or hill method, and (2) the specially designed storage house. The construction of the latter is described in some detail, and the cost of curing sweet potatoes by this method is estimated at 68.1 cts. per bushel.

Relationship between the average wheat yield and the winter rainfall, A. E. V. Richardson (*Jour. Dept. Agr. Victoria, 14* (*1916*), *No. 1, pp. 37–40, fig. 1*).—This article is based on observations of the relationship between the average yields of wheat and the composite average rainfall over the wheat belt from May to October for the past 25 years. Ten centers, representative of the wheat districts, were chosen in which observations were made. The past 24 seasons were divided into two 12-year periods, each having approximately the same composite average rainfall, namely, 9.5 in. for the first period and 9.8 in. for the second period. The results obtained are illustrated by means of a graph and are discussed in some detail.

In a comparison of the yields with the rainfall it is shown that for every inch of winter rainfall 0.77 bu. of wheat was secured per acre in the first period and 1.12 bu. per acre in the second period. This indicates a gain of 46 per cent brought about by improved methods of cultivation. The effect of abnormal seasons on wheat production is discussed. It is pointed out that the wheat crop of Victoria may be estimated in November from a knowledge of the winter rainfall in the typical wheat districts.

Experiments with the manuring of wheat, F. Coleman (*Jour. Dept. Agr. So. Aust., 19* (*1916*), *No. 8, pp. 716–718*).—This is a report of experiments conducted for the past eleven years on the manuring of wheat. Increased yields and values of manured plats over unmanured plats for the 11-year period are given in tabular form.

Researches on wheat selection.—I, Does the value of a wheat grain depend on its position in the ear? A. E. V. Richardson and W. H. Green (*Jour. Dept. Agr. Victoria, 14* (*1916*), *No. 3, pp. 140–146, figs. 4*).—This article reports experiments with wheat conducted at the Rutherglen Experiment Station, Victoria. In order to eliminate environmental influences as far as possible, a

modification of the system of centgener plats suggested by Hays (E. S. R., 13, p. 165) was adopted. The investigations were conducted with the Federation variety of wheat. Forty-three ears of wheat were examined and the kernels removed and weighed and their position in the ear marked. In addition, these weighed and marked kernels were planted, and their location carefully marked to test the fertility and vigor of kernels at different positions in the ear and in the spikelet.

The results obtained indicated that the weight of individual grains increases from either extremity to the middle of the ear. The middle kernels of the spikelets are invariably less in weight and impoverished and, if they germinate, produce less prolific plants. As these grains are undersized and low in weight an efficient grading machine eliminates them. In mass selection for crop improvement the rejection of the upper and lower portions of the ear of wheat is deemed justifiable.

The cross-fertilization of wheats, W. J. Spafford (*Jour. Dept. Agr. So. Aust.*, *19* (*1915*), *No. 4*, *pp. 362–375*, *figs. 6*; *19* (*1916*), *No. 7*, *pp. 628–633*).—This article is a detailed discussion of the principles involved and the methods used in the cross-fertilization of wheats.

Wheat breeding in New South Wales, J. T. Pridham (*Agr. Gaz. N. S. Wales*, *26* (*1915*), *Nos. 7*, *pp. 563–567*; *8*, *pp. 645–650*; *9*, *pp. 737–741*; *12*, *pp. 1013–1017*).—This article consists chiefly of the assembling and discussion of the underlying principles of plant breeding as formulated by Mendel, De Vries, Johannsen, and others, and supplemented by breeding investigations with wheat in New South Wales. The American Breeders' Association Yearbook for 1907 is quoted at some length.

Notes on some recently imported wheats, F. B. Guthrie and G. W. Norris (*Agr. Gaz. N. S. Wales*, *26* (*1915*), *No. 12*, *pp. 1018–1022*).—The results of milling and baking tests applied to Russo-Barletta, White Walla, Red Walla, Blue Stem, and Baril, all imported Argentine wheats, are reported. Russo-Barletta and Baril appear to be the most satisfactory milling wheats. An unnamed variety of wheat imported from Japan and Red Fife from Oregon were also tested.

Seed wheat.—Varieties for distribution among farmers, A. E. V. Richardson (*Jour. Dept. Agr. Victoria*, *14* (*1916*), *No. 2*, *pp. 65–78*, *figs. 9*).—This article deals with the methods employed by the Victoria department of agriculture in developing varieties of wheat for distribution among farmers. The value of seed selection and grading is pointed out. All varieties are started on 1/10-acre "stud" plats from which seed is selected for 1-acre "seed" plats, which in turn furnish seed for 10-acre "bulk" plats. More or less detailed notes are given on 16 varieties that have been developed, including information as to yielding qualities, cultural characteristics, disease resistance, etc.

Cost of production of field crops, H. C. Wilson and A. J. Whelan (*Jour. Dept. Agr. Victoria*, *14* (*1916*), *No. 5*, *pp. 296–307*, *figs. 4*).—An itemized statement of the cost of harvesting wheat in Victoria is given. Three operations are compared, namely, harvesting 12 acres for hay, harvesting 309 acres with a binder for threshing, and stripping and winnowing 24 acres.

Improved apparatus for determining the test weight of grain, with a standard method of making the test, E. G. Boerner (*U. S. Dept. Agr. Bul. 472* (*1916*), *pp. 15*, *figs. 8*).—This bulletin describes an apparatus for accurately determining the test weight of grain, especially designed for use in grain standardization work. The common practices met with in commercial grading are compared and their imperfections pointed out. A standard method for making all such tests is urged, and specifications submitted for that purpose.

Rules and regulations of the Secretary of Agriculture under the United States Grain Standards Act of August 11, 1916, D. F. HOUSTON (*U. S. Dept. Agr., Office Sec. Circ. 70 (1916), pp. 54*).—This circular contains the rules and regulations of the Secretary of Agriculture pertaining to the United States Grain Standards Act of August 11, 1916. The text of the act (E. S. R., 35, p. 308) is included.

Clover and grass seed inspected in 1914, C. P. SMITH (*Maryland Sta. Bul. 197 (1916), pp. 58*).—Seed inspections of red clover, crimson clover, sweet clovers, alfalfa, alsike and white clovers, hairy vetch, timothy, millets, and orchard grass for 1914 are reported.

A table of tolerance for purity variations is given and an explanation made of its calculation and use.

Anatomical determination of the seeds of Cuscuta trifolii and C. suaveolens, J. BERNATSKY (*Landw. Vers. Stat., 88 (1916), No. 1-2, pp. 1-11, figs. 7*).—The results are reported of an anatomical study of the seeds of two species of dodder, conducted to determine the cause of the so-called limy or calcareous condition of some seeds, and to discover a method for the recognition of the species of such seeds in doubtful cases.

It is stated that the limy seeds show no indication of parasitism, but that they are seeds which, having failed of fertilization, dry up in the condition or stage of development reached before the time of fertilization arrives. The anatomical differences determined were as follows: In limy seeds of *C. trifolii* the proportion of the thickness to the length was as 1 : 1.4, and in those of *C. suaveolens* as from about 1 : 1.6–1 : 1.9. The palisade cells in the limy seeds of *C. trifolii* were from 6 to 8 μ in the first row, about 8 μ in the second, and only near the hilum perceptibly more than 8 μ in length, as compared with from 8 to 16 μ in the first row and 10 to 30 μ and over in the second row in similar seeds of *C. suaveolens*. The starch grains of the limy seeds did not prove of value for a systematic classification.

A new weed, G. QUINN and H. W. ANDREW (*Jour. Dept. Agr. So. Aust., 19 (1915), No. 4, pp. 380–383, figs. 3*).—The appearance of the cruciferous weed *Carrichtera annua* is reported in a limited area of South Australia. A botanical description of the plant is given.

Some points in fan weed control (*Montana Sta. Circ. 12, Sup. (1915), pp. 4*).—This circular supplements a publication previously noted (E. S. R., 28, p. 46), dealing with fan weed (*Thlaspi arvense*), its introduction into new territory, and its control.

HORTICULTURE.

[Horticultural investigations in Alaska], C. C. GEORGESON, J. P. ANDERSON ET AL. (*Alaska Stas. Rpt. 1915, pp. 8–13, 15, 22, 29–32, 33–39, 50–52, 67, 68, 76, pls. 5*).—The horticultural work at the Sitka Station and at the branch stations was continued along lines previously noted (E. S. R., 33, p. 637).

The numerous crosses between cultivated strawberries and the wild species of Alaska have yielded many plants of sufficient merit to be retained for further test and experiment. Some of these hybrids with the coast species as one of the parents have been found to be hardy at both Rampart and Fairbanks stations, but hybrids that have the interior species for one of their parents are expected to be better adapted for that region than are those now under test. The raspberry-salmonberry crosses made several years ago (E. S. R., 28, p. 435) have yielded plants of no value, and this breeding work has been discontinued. Some hybrids between the raspberry and the thimbleberry (*Rubus parviflorus*) and between a native crab apple and early summer apples fruiting at the Sitka

Station have been secured and are under observation. Selection and breeding studies are also being conducted with gooseberries, cranberries, blueberries, and huckleberries.

The season of 1915 was favorable for fruit production in the station's test orchard and a number of early-maturing apples fruited. The tests thus far made have shown that only the early-maturing apples are adapted to Alaska. Of these Yellow Transparent and the Livland Raspberry are the only two that can be recommended at this time. Of the cherries, only sour cherries have proved of any value as orchard trees, and in most seasons even sour varieties are more or less a failure. Thus far, other orchard fruits have not been successful.

The usual variety tests with vegetables are reported, and data are given on the adaptability of various ornamental trees, shrubs, perennials, and annuals to conditions at the stations.

Notes on some garden plants cultivated in the experimental garden of the Portici Royal Agricultural High School, F. de Rosa (*Atti R. Ist. Incoragg. Napoli, 6. ser., 67 (1915), pp. 251–272*).—This comprises notes on the condition and character of different classes and varieties of vegetables grown in the school garden.

Two winter salads, endive and Witloof, L. Bussard (*Vie Agr. et Rurale, 6 (1916), No. 46, pp. 354–356, figs. 3*).—The methods employed in forcing endive and Witloof chicory during the winter months are described.

Modern fruit marketing, B. S. Brown (*New York: Orange Judd Co., 1916, pp. XIX+283, figs. 136*).—In the present treatise the practices of harvesting, packing, storing, transporting, and selling of fruit are considered in detail.

The Christ-Junge taxation method; general rules for the application of the method for all horticultural plants (*Maandbl. Nederland. Pomol. Ver., 6 (1916), Nos. 4, pp. 73–80; 7, pp. 148–163; 8, pp. 166–174; 9, pp. 194–202*).—This article discusses in detail a method of taxing fruit trees which have not come into bearing, those which are yielding normal crops, and those which have passed their prime. The method here considered was advanced by Dr. Christ and E. Junge in their guide for the determination of the worth and rental value of fruit industries.[1]

The cost of producing apples in Wenatchee Valley, Washington, G. H. Miller and S. M. Thomson (*U. S. Dept. Agr. Bul. 446 (1917), pp. 35, pls. 4, figs. 7*).—This comprises a detailed study made in 1914 of the current cost factors involved in the maintenance of orchards and the handling of the crop on 87 orchards.

The average investment per farm surveyed was $20,974; the average investment per acre of bearing apples alone was $1,925. The equipment investment was $444 per farm, or $47 per acre, exclusive of stock. There was an average of two horses per farm, or 5.3 tillable acres per horse. The orchards studied averaged 6.5 acres and 81 trees per acre, and the trees averaged 11 years of age.

The total annual cost of production was $469.73 per acre, or 79.2 cts. per box, f. o. b. Of this, labor cost constituted $179.09 per acre, or 30.2 cts. per box, and cash cost, including interest on investment, $290.64 per acre, or 49 cts. per box. This was the annual cost for the average orchard under clean cultural management, and where under alfalfa or clover management, this cost was reduced about 2 cts. per box. The yield per acre on the bearing orchards from which data were secured was 593 boxes, or 7.3 boxes per tree. This represents all yields on trees from 7 to 11 years, inclusive.

[1] Anleitung für die Wert und Rentabilitätsberechnung der Obstkulturen auf neuer Grundlage. (Berlin: P. Parey, 1913, 2. rev. and enl. ed., pp. VIII + 175.)

The ten leading varieties in the bearing orchards were Winesap, Jonathan, Esopus, Rome Beauty, Stayman, Gano, Ben Davis, Yellow Newton, Arkansas (Mammoth Black Twig), and Arkansas Black. In orchards of from one to five years of age varieties such as Delicious, Winter Pearmain, and Banana are replacing varieties like Ben Davis, Arkansas, and Arkansas Black.

The general cost of establishing a meadow orchard of cider apples, A. Truelle (*Vie Agr. et Rurale, 6 (1916), No. 48, pp. 391–396, figs. 5*).—A discussion with estimates of cost entering into the establishment of a cider orchard in land used for pasture.

Methods and problems in pear and apple breeding, W. R. Ballard (*Maryland Sta. Bul. 196 (1916), pp. 79–92, figs. 3*).—Investigations in the improvement of orchard fruits have been conducted by various investigators at the station for 11 years. The data secured from these breeding projects are reserved for a later publication. The present bulletin is limited to a discussion of some of the methods which have been found useful and some of the problems which have been encountered in these investigations. The phases discussed include knowledge of varieties, the blooming period, collecting and ripening pollen, emasculation, pollination, bagging and labeling, setting of the fruit, gathering and planting the seed, handling the seedlings, early elimination of undesirable types, the permanent planting, and the fruiting age. A summary is given of the pear and apple crosses made at the station showing the number of buds pollinated and the number and percentage of fruit set.

Pear breeding, W. R. Ballard (*Jour. Heredity, 7 (1916), No. 10, pp. 435–442, figs. 4*).—This comprises a reprint of the greater part of the above noted bulletin.

Growing cherries east of the Rocky Mountains, H. P. Gould (*U. S. Dept. Agr., Farmers' Bul. 776 (1916), pp. 36, figs. 29*).—A treatise on cherry culture discussing the extent and distribution of cherry growing, locations and sites for cherry orchards, methods of propagation, selection of stocks and trees, the season for planting trees, care of trees when received from the nursery, preparation of the land, planting operations, pruning at time of planting, tillage and maintenance of soil fertility, intercrops, irrigation, pruning, fungus diseases and insects and other pests, picking and handling the fruit, varieties, the sterility of sweet cherries, the sequence of ripening of different varieties, and the future planting of cherries.

Self-sterility in dewberries and blackberries, L. R. Detjen (*North Carolina Sta. Tech. Bul. 11 (1916), pp. 5–37, figs. 9*).—This bulletin presents in detail the results of an investigation of the extent and causes of sterility among varieties of dewberries and blackberries and their hybrid forms.

In the work with blackberries, which was conducted through three successive seasons, the 11 true blackberry varieties included in the study proved to be self-fertile, one hybrid blackberry was partially self-sterile, and three hybrids were self-sterile. In case of the dewberries, on the other hand, 10 of the true dewberries were self-sterile and three of the hybrid dewberries were self-fertile, thus indicating that sterility apparently occurs only in dewberries and their hybrids with blackberries. Examination of the origin of the different varieties of dewberries tested showed that all of the varieties that are pure lineal descendants of *Rubus trivialis* and those varieties in which *trivialis* blood predominates are self-sterile, while those varieties that come from *R. villosus* are generally self-fertile. Among the factors studied and discarded as not explaining the general sterility among dewberries are the structure of the flower, disease, daily blooming period of varieties, amount of pollen produced by the flower, environment, sterility due to hybridism, and the percentage of defective pollen grains produced. The author concludes that the self-sterility among

dewberries and hybrid varieties that are grown either as dewberries or as blackberries can be attributed either to a nonattraction or to a repulsion of the sexual elements from the same plant or from the same variety.

The pollen from most of the self-sterile varieties will successfully fertilize flowers of other self-sterile or self-fertile varieties. Fully self-fertile dewberry plants and blackberry plants when self-pollinated produce apparently as good fruits as when cross-pollinated. The results of the study as a whole indicate that by judicious and careful selection of varieties one or several varieties may be included in the fruit plantation with a reasonable certainty of a good setting of fruit. In the case of partially self-fertile varieties and all of the recognized self-sterile varieties of dewberries and blackberries a good pollenizer is absolutely necessary. Under ordinary conditions several varieties should be included in the plantation so as to secure the best possible results from cross-pollination.

The sycamore fig in Egypt, T. W. BROWN and F. G. WALSINGHAM (*Jour. Heredity, 8 (1917), No. 1, pp. 3–12, figs. 7*).—An account of the sycamore fig with reference to its history, botany, and practices employed by the natives in the culture and ripening of the fig.

The best papaws (*Jour. Heredity, 8 (1917), No. 1, pp. 21–33, figs. 7*).—This article describes a number of papaw fruits and trees reported in 1916 as the result of prizes offered by the American Genetic Association for photographs of the largest papaw trees and for the best papaw fruits.

Cocos nucifera, F. W. T. HUNGER (*Cocos nucifera. Amsterdam: Scheltema & Holkema, 1916, pp. XII+146, pls. 40, figs. 12*).—A handbook on the knowledge of the coconut palm in the Dutch East Indies, including detailed information relative to its history, botany, culture, and products.

The cultivation of limes, J. B. HARRISON, C. K. BANCROFT, and G. E. BODKIN (*Jour. Bd. Agr. Brit. Guiana, 8 (1915), No. 4, pp. 135–142; 9 (1915), No. 1, pp. 4–10; 9 (1916), No. 3, pp. 122–129; 10 (1916), No. 1, pp. 6–8*).—A popular treatise on lime culture, with special reference to British Guiana. In addition to cultural details information is given relative to the control of insect pests and diseases, cost of establishing a lime plantation, and preparation of lime products.

The vanilla plantations of Tahiti and Moorea, E. P. MEINECKE (*Les Vanillières de Tahiti & de Moorea. Papéiti: Govt., 1916, pp. 44*).—This embraces the results of a survey of the vanilla industry in the islands of Tahiti and Moorea. Information is given relative to the nature and extent of the industry; the various pests of vanilla, together with suggestions for their control; and the improvement of cultural methods.

Germination of yerba, V. GARIN (*Bol. Min. Agr. [Argentina], 20 (1916), No. 7–8, pp. 568–577, fig. 1*).—The results are given of some germination tests of yerba maté seeds previously treated in different ways mechanically, chemically, and by stratification.

Yerba maté (Ilex paraguayensis), G. T. BERTONI (*Bol. Min. Agr. [Argentina], 20 (1916), No. 7–8, pp. 578–592*).—A paper similar to the above dealing with different methods of treating yerba maté seed preliminary to planting.

The American nut industry, H. A. GOSSARD (*Ohio Forester, 8 (1916), No. 3, pp. 29–33*).—A review of the American nut industry in its various phases, based largely on the literature of the subject.

Effects of large applications of commercial fertilizers on carnations, G. D. BEAL and F. W. MUNCIE (*Jour. Amer. Chem. Soc., 38 (1916), No. 12, pp. 2784–2804*).—This paper presents the data secured in a study of the causes and effects of overfeeding with the more ordinarily used commercial fertilizers. The fertilizers chosen for the experiment were dried blood, sodium nitrate, am-

monium sulphate, acid phosphate, disodium phosphate, and potassium sulphate. For comparison, sodium chlorid and sodium sulphate also were used on some sections. The work was conducted during the period 1912 to 1915. The more practical results relative to the injurious and beneficial effects of specific fertilizers have also been published in a previous paper (E. S. R., 32, p. 746). The additional data here given deal with alterations in plant activities and constituents due to the fertilizers. A bibliography of related literature is appended.

Determinations of dry weight and ash made from the foliage of the carnation plants showed an increase in both values with increased applications of fertilizers. An increased content of the fertilizing salts was detected in the plants after large applications of them to the soil. The total nitrogen determinations made upon plants in different stages of injury showed an increased intake of nitrogen when ammonium sulphate was applied, but an acquired tolerance by the plants when successive small applications were made. Injury from ammonium sulphate was not in proportion to the total nitrogen content.

Osmotic pressure determinations made upon the cell sap proved that with each fertilizer used the degree of injury varied with the osmotic pressure, but that not the same degree of injury was caused by different fertilizers at the same osmotic pressure. Injury is not a result of increased osmotic pressure exclusively. The increase in the osmotic pressure in a series of plants on soil receiving increasing applications of commercial fertilizers was accompanied by an increase in the total solids and ash of the sap and in the amount of the fertilizer taken up by the plant.

The total acidity of the sap of plants fed with ammonium sulphate, disodium phosphate, and monocalcium phosphate increased as indicated by phenolphthalein. The relation between the increase in total acidity and in the phosphorus content of the sap when the plants were fed with disodium phosphate proved that the phosphorus was taken in the form of dihydrogen phosphate, due not entirely at least to absorption of the base by the soil, but to the selective action of the plant as well.

Applications of potassium sulphate had no effect upon the acidity of the sap, but large applications gave a higher total sugar content in the sap from the stems of the plants as well as in the foliage. The starch content of the foliage of such plants was lower. These data indicate a more rapid hydrolysis of the starch in the foliage in the presence of an excess of potassium sulphate. The increased exudation of nectar observed in the flowers of these plants probably resulted from this increase in sugar content.

The history and botanical relationships of the modern rose, E. H. and F. A. Wilson (*Boston: Authors, 1916, blueprint*).—This consists of a chart prepared with the view of showing the progress in the evolution of the modern rose.

Some suggestions for improvement of the home grounds, W. H. Sill (*Pan Handle* [*W. Va.*] *Agr. Club Circ. 3* (*1916*), *pp. 25, figs. 5*).—A popular treatise on the questions arising in the improvement and development of the home surroundings applicable to the small city lot, the suburban estate, and the farm.

FORESTRY.

Handbook for rangers and woodsmen, J. L. B. Taylor (*New York: John Wiley & Sons, Inc., 1917, pp. IX+420, figs. 243*).—The object of this handbook is to serve as a guide for inexperienced men in woods work. Although the author has had primarily in mind the problems which confront a forest ranger in government, state, or private employ, it is believed that the suggestions offered may be of use to others whose work or recreation takes them into rough

and unsettled regions. The subject matter is discussed under the general headings of equipment, construction work, general field work, live stock, and miscellaneous. Numerous tables and miscellaneous information, together with a glossary of local and technical terms used of value to the forester, are appended.

Ecological investigations upon the germination and early growth of forest trees, R. H. BOERKER (*Thesis, Univ. Nebr., 1916, pp. 90, pls. 5, figs. 23; Univ. [Nebr.] Studies, 16 (1916), No. 1–2, pp. 1–89, pls. 5, figs. 23*).—A doctorate thesis to the faculty of the graduate college of the University of Nebraska, and constituting an inquiry into the effect of the more important habitat and seed factors upon the germination and early development of certain American forest trees for the purpose of obtaining data that may be used in the silvicultural management of these species. The author's observations were made on control cultures in the greenhouse. The results are presented in tabular form and fully discussed. A bibliography is appended.

The significance of certain variations in the anatomical structure of wood, R. P. PRICHARD and I. W. BAILEY (*Forestry Quart., 14 (1916), No. 4, pp. 662–670, fig. 1*).—This paper summarizes the results of one of a series of investigations that have been undertaken at the Bussey Institution in the study of plant tissues and cells, their comparative structure, relative conservatism, and behavior under the influences of various modifying factors. The present investigation deals with the variation in size of the principal woody elements (fibers and vessel segments) in various parts of the stem of the common shagbark hickory (*Carya ovata*).

Relationship of the Douglas fir to lime in soil, SOMERVILLE (*Quart. Jour. Forestry, 11 (1917), No. 1, pp. 1–6*).—An inspection of some Douglas fir plantations occurring in chalk lands led the author to conclude that, contrary to a rather common opinion, Douglas fir is more or less tolerant of lime, and may be recommended for planting even where solid chalk occurs within 2 ft. of the surface and where abundant lumps of chalk are met with even at a less depth.

The girth increment of Hevea brasiliensis, T. PETCH (*Ann. Roy. Bot. Gard. Peradeniya, 6 (1916), No. 2, pp. 77–86, pls. 5*).—In January, 1912, regular girth measurements on *H. brasiliensis* were begun at Peradeniya as part of an investigation into certain phases of the physiology of the tree. Tabular data are given showing the girth increases for 16 trees up to March, 1914, together with growth curves of untapped and tapped trees.

Sugar pine, L. T. LARSEN and T. D. WOODBURY (*U. S. Dept. Agr. Bul. 426 (1916), pp. 40, pls. 10*).—An account of the sugar pine (*Pinus lambertiana*) with reference to its importance, geographical and commercial range, botanical characteristics, growth, silvical requirements, reproduction, and forest types. Consideration is also given to the mechanical and physical properties of the wood, methods of logging and milling, values and grades of lumber, markets, uses, stumpage prices, growth and yield, and management, including the management of private timber lands. Appended to the bulletin are a volume table, based upon measurements of 910 felled trees taken by the Forest Service in California; a key for the identification of sugar pine, western white pine, and white pine woods; and a classification of sugar-pine lumber into grades.

The forests of Worcester County, H. O. COOK (*Boston: State, 1917, pp. 88, pls. 7, figs. 3*).—This comprises the results of a forest survey of the 59 towns in Worcester County, Mass., together with a study of their lumber industry. The data given for each town include the acreage in various forest types and age classes, the acreage in nonforest types, and the wood-using industries.

Improving the woodlot, J. B. BERRY (*Ga. State Col. Agr. Circ. 31 (1916), pp. 8, figs. 2*).—A popular treatise on woodlot management.

Scientific national forestry for New Zealand, D. E. Hutchins (*Jour. Agr. [New Zeal.], 13 (1916), Nos. 4, pp. 295–317, figs. 4; 5, pp. 375–396, figs. 4*).—An account of the forests and forest conditions in New Zealand, with suggestions relative to the development of scientific forestry in the dominion. The subject matter is based upon the author's investigations on behalf of the government relative to the forests and forestry in New Zealand.

Annual return of statistics relating to forest administration in British India for the year 1914–15 (*Statis. Forest Admin. Brit. India, 1914–15, pp. 25, pl. 1*).—A statistical report relative to alterations in forest areas, progress of forest settlements, forest surveys, working plans, forest protection, planting operations, yields in major and minor forest products, revenues, expenditures, etc. Data are also given showing the revenue, expenditure, and surplus during the 25 years from 1890–91, together with a diagram showing the annual forest revenue, expenditure, and surplus for the 10 years, 1905–6 to 1914–15.

Snow injury to trees, G. B. Rigg (*Torreya, 16 (1916), No. 12, pp. 257–260*).—Observations on mechanical injury by snow to evergreen trees in the Puget Sound region during the winter of 1915–16 are given. The most striking fact observed was the large amount of injury to needle-leaf evergreens and the small amount of injury to broad-leaf evergreen trees and shrubs.

Forest fires in the United States in 1915, J. G. Peters (*U. S. Dept. Agr., Office Sec. Circ. 69 (1917), pp. 6*).—This circular presents the results of the first attempt to secure annual estimates of all forest fires in the United States. Thirty-seven States sent in returns which represent approximately 56 per cent of the forest area of the country. Tabular data are given showing the number and causes of fires reported in 1915, with the area burned over, and the amount of damage, and also an estimate for the territory from which no reports were received.

The actual losses on the 177,500,000 acres of Federal and private lands within the National Forest boundaries was $353,389 and the estimated loss on all other forest lands in the United States is given as $6,755,967. Within the National Forest boundaries 279,245 acres were burned over, as compared with an estimate of 5,627,405 acres on all other forest lands.

Forest insurance against fires in Finland, E. Nylander (*Skogsvårdsför. Tidskr., 14 (1916), No. 8, pp. 625–628*).—A short account of forest fire insurance in Finland, which was originated in 1914 and met with great success, a sum of 85,000,000 marks ($16,405,000) being the immediate amount insured for.

Better apparatus for forest fire fighting, H. C. Johnson (*Canad. Forestry Jour., 13 (1917), No. 1, pp. 896–899, figs. 7*).—Some successful results with a portable engine pump in fighting forest fires in Quebec are briefly discussed.

DISEASES OF PLANTS.

Plant diseases, J. P. Anderson (*Alaska Stas. Rpt. 1915, pp. 39–41*).—Notes are given on the occurrence of diseases of a number of economic plants grown in the trial grounds of the Sitka Station.

Mycology, F. J. F. Shaw (*Ann. Rpt. Bd. Sci. Advice India, 1914–15, pp. 104–109*).—At Pusa it was found that although the ufra disease of rice can lie dormant in the soil and infect the young plants, cutting the diseased rice and burning it in place with a little kerosene oil prevented infection of the next crop. A rice disease at Balasore and at Bankipore could not be traced to any parasitic agent. Gwa-bo, which caused extensive damage in Burma, was investigated with no very definite result, *Sclerotium oryzæ* appearing in about half the cases but probably not as a primary cause, and several insects as more probably causative in many cases.

Field experiments with tokra of tobacco have already yielded some results. *Orobànche cernua* and *O. indica* occur on tobacco, the latter being much more serious to solanaceous crops and the former causing more damage to crucifers. The effects of chemical manures on the influence of tokra are being tested.

Black thread of Hevea in Lower Burma, characterized externally by black lines in the tissue above the tapping cut and by failure of the tree to regenerate the bark over the tapped area, has not yet proved to be due to a fungus parasite but hyphæ of a Phytophthora have been found in adjacent bark.

A disease of sal (*Shorea robusta*) in the forests of the Duars was associated in every dead or dying tree with the presence of a rhizomorphic root fungus showing sporophores in advanced cases, and all showed a diseased condition of the phlœm. The disease may prove to be due to a Fomes, the conditions for attack by which are not yet known.

Rhizoctonia napi was found to be a serious parasite of mustard and gram, though limited by its inability to grow actively at temperatures above 29° C. (80.3° F.). A fertile stage discovered is said to be identical with *Botrytis cinerea*. *R. destruens* causes a serious disease of betel vine and potato in Bengal, and it also occurs on suran, alfalfa, and peanut. This fungus may have a perfect stage in the genus Corticium. Experiments suggest that corrosive sublimate is more reliable as against Rhizoctonia than is either formalin or copper sulphate. Studies regarding the causation of blight of opium poppy render it probable that Rhizoctonia is seriously parasitic on this plant only under bad conditions, such as poor soil or defective drainage. *Peronospora arborescens* was abundant on poppy near Ghazpur.

Anthracnose of betel vine was investigated with slight results. Anthracnose of chillies caused much trouble in Burma.

Preliminary study of the soil floras of India showed a striking similarity of these with those of Europe. The red rot sugar cane fungus attacked juar under laboratory conditions. A banana rot was caused by a Fusarium, this disease appearing to be distinct from the Panama disease of bananas. The potato blight fungus is not able to survive in the heat of the plains. Results are to be published soon of a study of Phytophthora in Vinca. A disease of chillies proved to be of the type known as wilt. In Bihar the treatment of oat smut with formalin was, as usual, completely successful.

An account of plant disease work by departments is given in brief form, and this is followed by a short list of publications during 1914–15.

Nonparasitic stem lesions on seedlings, C. HARTLEY (*Abs. in Phytopathology, 6 (1916), No. 3, pp. 308, 309*).—Attention is called to a disease affecting the bases of the stems of young seedlings of conifers and various herbaceous plants, for which the name white spot is proposed. In many ways this disease resembles damping-off and is frequently confused with it, but it is considered that the disease is caused by high temperature at the soil surface, probably combined with the effects of light.

Life history and poisonous properties of Claviceps paspali, H. B. BROWN (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 9, pp. 401–406, pl. 1, figs. 2*).—In continuation of previous work (E. S. R., 34, p. 676), the author gives the results of an investigation carried on at the Mississippi Experiment Station on the life history and poisonous properties of this ergot.

The fungus has been found quite abundantly in the vicinity of this station, at least 90 per cent of old heads of *Paspalum dilatatum* showing infection. Inoculation experiments have demonstrated the possibility of producing the disease. It has been observed that the sclerotia are readily found on the ground during the winter, where they remain until spring. In addition to the

ergot, two other fungi, *Fusarium heterosporum* and *Cladosporium* sp., are reported as infecting the heads of *P. dilatatum*. A brief account is given of experiments in feeding the sclerotia, as well as extracts made from the fungus, to guinea pigs, from which it appears that only the old sclerotia are poisonous and that they retain this property for at least 10 months.

Mowing pastures as often as the sclerotia become abundant is said to be an effective method of preventing poisoning, and this measure is of practical value in most places.

Neocosmospora vasinfecta on potato and adzuki bean, F. A. Wolf (*Phytopathology, 6 (1916), No. 3, p. 301*).—The author adds to the known host species of this fungus potatoes and adzuki beans, the organism found upon these plants agreeing morphologically with that recently described from peanuts (E. S. R., 32, p. 546).

Pleosphærulina on alfalfa, F. R. Jones (*Phytopathology, 6 (1916), No. 3, pp. 299, 300*).—On account of a publication by Melchers (E. S. R., 33, p. 848) relating to a new alfalfa leaf spot in America, the author was led to contribute certain facts regarding the distribution, cultural habits, and taxonomy of the fungus, which has been observed in Madison, Wis., and Auburn, Ala., and has also been collected in Iowa, Minnesota, South Dakota, and Indiana.

Dissemination of bur clover leaf spot, F. A. Wolf (*Phytopathology, 6 (1916), No. 3, p. 301*).—The leaf spot of bur clover due to *Cercospora medicaginis* has been found to be spread by means of bur clover seed, and it is recommended that the seed be immersed for one minute in boiling water to prevent the occurrence of the disease. This treatment seems not only to destroy the fungus but also to hasten the germination of the bur clover seed.

Experiments to control late blight of celery (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 41 (1915), p. 17*).—As a result of three years' experiments it is claimed that in seasons of normal rainfall losses from the late blight of celery can be prevented by spraying with a 4:4:40 Bordeaux mixture, beginning with the plants in the seed bed and continuing the spraying at intervals of ten days or two weeks throughout the growing season.

The Rio Grande lettuce disease, C. W. Carpenter (*Phytopathology, 6 (1916), No. 3, pp. 303–305, fig. 1*).—A brief account is given of investigations of a lettuce disease occurring in the lower Rio Grande Valley, in which there is a reddening of the older leaves and blanching of the younger ones, restricted development of newly forming leaves accompanied by small, dark-colored blister spots along the border, and the development of numerous lateral adventitious shoots and dry and dead small roots. Analyses were made of the irrigation water used and of the soil about the affected plants, and it is believed that the trouble in question is due to the presence of alkali.

A new smut on Sorghum halepense, I. B. P. Evans (*So. African Jour. Sci., 12 (1916), No. 11, pp. 543, 544, pl. 1*).—A technical description is given of *Sorosporium simii* n. sp., which is said to attack Johnson grass in South Africa. Attention is called to this fungus and to the fact that it will probably attack Sudan grass unless precautions are taken against its introduction.

Control of the sugar beet nematode, H. B. Shaw (*U. S. Dept. Agr., Farmers' Bul. 772 (1916), pp. 19, figs. 6*).—A popular account is given of the sugar beet nematode (*Heterodera schachtii*), which, it is said, has been introduced into the United States and has become established in several sugar-beet districts of the West, where it causes considerable injury.

It is claimed that the only practical method of controlling the pest on a large scale is the rotation of crops not attacked by this nematode. Where small areas of land are infested, it is claimed that the nematodes may be eradicated by the liberal application of unslaked lime, which should be thoroughly

mixed with the infested soil. All forms of the nematode are said to be destroyed by short exposure to dry heat, the seed not being injured when exposed for ten minutes to temperatures of 149 to 158° F. This is suggested as a method for the control of the nematode if it should be established that it is introduced through the seed.

Rhizoctonia and Sclerotium rolfsii on sweet potatoes, L. L. HARTER (*Phytopathology, 6 (1916), No. 3, pp. 305, 306*).—The author reports the presence of Rhizoctonia on sweet potatoes, particularly in seed beds which have been too frequently watered, and of *S. rolfsii* on similar plants. The latter fungus is said to be quite destructive in Florida and Texas, sometimes completely destroying all plants in a hotbed.

A specific mosaic disease in Nicotiana viscosum distinct from the mosaic disease of tobacco, H. A. ALLARD (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 11, pp. 481–486, pls. 2*).—The author reports having observed in the trial grounds at Arlington, Va., three plants of *N. viscosum* and a hybrid plant between that species and *N. tabacum* showing unmistakable symptoms of mosaic disease. This disease in its symptoms seems identical with the mosaic disease of tobacco, but the virus behaves very differently from that of tobacco mosaic disease in all inoculation tests. The author is of the opinion that this is a distinctive type of mosaic disease affecting *N. viscosum* and that in some manner it has originated from the ordinary form of mosaic disease.

During the same season, the author's attention was called to the typical symptoms of mosaic disease in peppers, which gradually spread over the whole field. Tomato plants in adjoining rows, however, were unaffected, and the expressed sap of the most severely affected pepper plants failed to produce the mosaic disease in young tobacco plants. Whether this disease was infectious to healthy pepper plants or was in some way related to the mosaic disease affecting *N. viscosum* was not determined.

Tomato blight, D. H. JONES (*Ann. Rpt. Ontario Veg. Growers' Assoc., 11 (1915), pp. 60–67, figs. 2*).—An account is given of a disease of tomato which may cause heavy losses from plants grown under glass, but which has been found to only a very limited extent in the field. The trouble resembles in many respects the brown rot of solanaceous plants, but it has not been connected with attack by fungi, bacteria, or insects. It is thought to be due to some soil factor, possibly an injurious chemical reaction affecting the plant through the root system. Good results have been obtained in a limited number of cases from treating the soil with steam.

Phytophthora infestans on tomatoes, F. D. KERN and C. R. ORTON (*Phytopathology, 6 (1916), No. 3, pp. 284–287, figs. 2*).—A report is given of an unusual outbreak of *P. infestans* on tomatoes in Pennsylvania in 1915. The fungus appears to attack leaves, stems, and fruit with about equal virulence, and there is believed to be some connection between weather conditions and the outbreak of the disease.

Phomopsis mali on young apple and pear trees in California, ELIZABETH H. SMITH (*Abs. in Phytopathology, 6 (1916), No. 3, p. 309*).—Attention is called to a disease of young apple and pear trees described by Roberts as due to *P. mali* (E. S. R., 28, p. 747). The trouble seems to be confined to one to three year old trees and is said to have been thus far of no great economic importance.

Observations on sour sap disease of apricots, EDITH H. PHILLIPS (*Abs. in Phytopathology, 6 (1916), No. 3, p. 309*).—Apricot trees are said to be affected with sour sap, or black heart, the first indication of the trouble being observed in the outer branches, which begin to die back, and in the wood in which brown

streaks are found. The disease appears during the summer and fall and is said to be particularly abundant in a wet year following one or two dry years.

Cultures have been made of soil protozoa, the material having been collected from diseased trees and from soil at the crown of apparently healthy trees. The protozoan fauna found in connection with the diseased trees was much more diverse and abundant than that from the sound ones.

A new leaf spot disease of cherries, B. A. RUDOLPH (*Abs. in Phytopathology, 6 (1916), No. 3, p. 308*).—A leaf spot disease of sweet cherries is reported from a number of points in California and Oregon. The spots produced are rather large, brown, and usually definitely limited. The disease in most but not in all cases seems to originate in an insect mine. No fungus spores or fruiting bodies have been found in the spots occurring in nature, but tissue plantings on sterile media have repeatedly yielded a species of Alternaria. Comparisons made between this fungus and *A. citri* and also a species of Alternaria from watermelon leaves showed the three species to be very similar but to be distinguishable by certain reactions.

The action of copper sulphate on downy mildew, L. SEMICHON (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 37 (1916), No. 14, pp. 325–331; Compt. Rend. Acad. Agr. France, 2 (1916), No. 11, pp. 372–384*).—The author reports results of experimentation and observations regarding the great variations noted in the duration of the efficacy of the reserve copper on the organs of grapevines, its mode of action, the conditions of its absorption, and the possibility of obtaining a greater and more certain efficacy in the copper employed.

After a period of desiccation, the proportion of soluble copper remaining available to oppose the fungus is found to be lowered in proportion to the subsequent precipitation. A short, light rain is much less disadvantageous in removing the available copper than a heavy and prolonged one. The proportion of reserve copper on the vines which may be redissolved as the result of precipitation decreases from day to day. The proportion of copper capable of being redissolved may be sufficient to kill or check spore germination, or it may be such as to favor spore development. The practical bearings of all these facts and of others noted are discussed, among these the action of the copper absorbed from the leaf surfaces or entering at points of injury during various developmental stages of the plant.

The action of copper salts against grape downy mildew, L. SEMICHON (*Rev. Vit., 44 (1916), Nos. 1134, pp. 224–230; 1136, pp. 255–261, figs. 2*).—This is a somewhat more extended account of the studies reported above.

Some new strawberry fungi, F. L. STEVENS and A. PETERSON (*Phytopathology, 6 (1916), No. 3, pp. 258–267, figs. 26*).—In continuation of a preliminary note (E. S. R., 33, p. 74) in which an account was given of some rots of strawberries, descriptions are given of *Sphæronæmella fragariæ* n. sp. and *Patellina fragariæ* n. sp. In addition to these species, other fungi were observed on berries in the field and market, and the authors claim that *Rhizopus nigricans* is the cause of most damage to shipped berries.

The diseases of bananas, J. E. VAN DER LAAT (*Bol. Agr.* [*São Paulo*], *17. ser., No. 2 (1916), pp. 151–160, figs. 3*).—This information has been noted from another source (E. S. R., 31, p. 244).

Sclerotium rolfsii on Citrus, F. A. WOLF (*Phytopathology, 6 (1916), No. 3, p. 302*).—The author reports that during the past season this fungus caused the death of seedling grapefruit in a greenhouse in Auburn, Ala.

Cottony rot of lemons in California, C. O. SMITH (*Phytopathology, 6 (1916), No. 3, pp. 268–278, figs. 5*).—This is essentially an abridgement of the bulletin previously noted (E. S. R., 34, p. 749).

A Glœosporium disease of the almond probably new to America, Helen L. Czarnecki (*Abs. in Phytopathology, 6 (1916), No. 3, p. 310*).—An account is given of a disease of almonds which is considered identical with that occurring in Italy caused by *G. amygdalinum*.

The hard rot disease of gladiolus, L. M. Massey (*New York Cornell Sta. Bul. 380 (1916), pp. 151–181, pls. 2, figs. 7; abs. in Phytopathology, 6 (1916), No. 1, p. 101*).—The author describes a hard rot disease of gladiolus which is due to *Septoria gladioli*. The trouble affects both the leaves and the corms, causing considerable loss. The symptoms and etiology of the disease are described, together with the results of experiments on control. Soil treatments with chemicals are said to have given results of little practical value. The fungus has been found able to live over the winter on dead tops lying upon the ground, and it is suggested that these should be raked up in the fall and burned. It has also been found that the fungus lives for at least four years in the soil, and on this account crop rotation should be practiced for the elimination of the organism.

Red leaf spot of Hippeastrum, P. I. Dougherty (*Abs. in Phytopathology, 6 (1916), No. 3, p. 309*).—In connection with the occurrence of conspicuous red spots on Hippeastrum, the author has isolated a fungus of a Phyllosticta type, and inoculations from single spore cultures have been successful in producing the disease.

Notes on oleander bacteriosis, C. O. Smith (*Abs. in Phytopathology, 6 (1916), No. 3, p. 308*).—The bacteriosis of oleander is said to be occasionally found in California on nursery stock, the organism causing galls on the stems, leaves, and inflorescences. From studies thus far made, certain differences are said to have been recognized between the oleander organism and the two other gall-producing organisms, *Bacterium savastanoi* and *B. tumefaciens*. The oleander organism has given negative results in inoculations of plants susceptible to the crown gall organism, and the olive knot organism has also given negative results when inoculated upon the oleander.

Spraying experiments to prevent rose leaf blotch (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 41 (1915), p. 17*).—As a result of experiments, it is claimed that the rose leaf blotch, due to *Actinonema rosæ*, may be prevented by repeated spraying with lime sulphur beginning before the buds open in the spring and repeating at intervals of ten days throughout the growing season, except when the roses are in bloom. This treatment is said to be more efficient than Bordeaux mixture for the control of this trouble.

Forest botany, R. S. Hole (*Ann. Rpt. Bd. Sci. Advice India, 1914–15, pp. 98–103*).—It is stated that the most important factors in the failure of sal (*Shorea robusta*) to reproduce itself may in the main be summed up as bad soil aeration and drought. Somewhat detailed discussion regarding these is given, with such remedial measures as a well aerated seed bed free from raw humus, full overhead illumination, and light side shade to prevent frost injury and retain moisture.

It is said that the spread of *Trametes pini* in stands of *Pinus excelsa* is effected chiefly by means of wind-borne spores entering through wounds in the stem, and that lopping should be prohibited.

A list is given of botanical and phytopathological publications.

Fungus diseases of trees, R. B. Maxwell (*Amer. Forestry, 22 (1916), No. 267, pp. 161–163, figs. 4*).—Discussion of a general character is given of some fungus tree diseases, classed according to incidence on the leaves, on the stem and branches, and on roots, with suggestions in regard to their control.

A fertile witches' broom on larch, P. Jaccard (*Schweiz. Ztschr. Forstw., 66 (1915), No. 7–8, pp. 139–145, pl. 1*).—Reporting observations on the character

and behavior of a large witches' broom of *Larix decidua* studied in Switzerland, the author states that his observations agreed with those of von Tubeuf (E. S. R., 24, p. 453), inasmuch as the characters of witches' broom may appear to be hereditary. He states that they are transmitted not only through the seeds, but also by means of grafts on normal trees.

Peridermium harknessii and Cronartium quercuum, E. P. MEINECKE (*Phytopathology, 6 (1916), No. 3, pp. 225–240, figs. 2*).—In continuation of a preliminary note (E. S. R., 34, p. 849), the author gives an account of investigations on the heterœcious stages of these species.

It is stated that, while not definitely proved, it is highly probable that *P. harknessii* is identical with *P. cerebrum*, and that in California *P. harknessii* and *C. quercuum* are to a high degree independent of each other. The heterœcism of *P. harknessii* on *Pinus radiata* is considered facultative, and it is believed highly probable that the same facultative heterœcism occurs in *P. contorta* and also in other hosts of *Peridermium harknessii*. *C. quercuum* winters over on *Quercus agrifolia*, new urediniospores forming in the spring around old, dead sori on old living leaves from which young leaves are infected. The heterœcism of the Cronartium is also considered facultative.

Pinus resinosa, a new host for Peridermium acicolum, R. G. PIERCE (*Phytopathology, 6 (1916), No. 3, pp. 302, 303*).—The author reports this rust as occurring on *P. resinosa*.

White pine blister rust (Peridermium strobi) (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 41 (1915), pp. 18–20*).—A summary is given of the results of inspection of white-pine plantations and cultivated currants, from which it appears that the white-pine blister rust is quite widespread in Ontario and is established on native white pine, wild currants, and gooseberries.

[Disease in pine and chestnut], F. W. RANE (*Ann. Rpt. State Forester Mass., 12 (1915), pp. 50–52*).—It is stated that the organism causing blister rust on white pine has been found on currants in the Housatonic Valley region, and it is feared that it may reach the pines.

Chestnut-bark disease is now to be found wherever chestnut grows in this section, the estimated proportion of trees attacked on a property at Mount Holyoke having risen from 5 per cent in September, 1912, to 90 per cent in November, 1915, and 75 per cent being in a dead or dying condition.

Spread of the chestnut blight in Pennsylvania, H. METCALF (*Phytopathology, 6 (1916), No. 3, p. 302*).—On account of the recent statements that the chestnut blight in Pennsylvania is coming to a standstill, the author presents a statement from the Deputy Commissioner of Forestry of Pennsylvania which indicates that the disease is continuing to spread rapidly in most localities.

Influence of Bordeaux mixture on the rates of transpiration from abscised leaves and from potted plants, W. H. MARTIN (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 12, pp. 529–548*).—The author has carried on a series of experiments at the New Jersey Station to determine the influence of Bordeaux mixture on the rates of transpiration of abscised leaves of several species, as well as to determine the effect of this spray material upon the rates of water loss from potted plants of tomato, cabbage, pepper, eggplant, and soy bean.

The results of these experiments are held to substantiate the general principle already established by Duggar and Cooley (E. S. R., 31, p. 825) that the rates of transpiration from both abscised leaves and the leaves of potted plants are materially increased by an application of Bordeaux mixture. A surface covering of dry powdered copper sulphate was less effective in accelerating rates of transpiration than was a surface film of Bordeaux mixture, but was more effective than a film of barium sulphate. The acceleration of transpiration rates by Bordeaux mixture was more pronounced when the spray was applied

to the abscised leaves than when applied to the leaves of potted plants. The influence of Bordeaux mixture in increasing rates of water loss from abscised leaves became apparent immediately after the spray dried upon the leaves. The effectiveness of a film of Bordeaux mixture for inducing increased rates of water loss appeared to vary considerably in different plants in the case of abscised leaves and, to a lesser degree, in case of potted plants.

Sulphur fungicides, G. P. GRAY (*Off. Rpt. Sess. Internat. Cong. Vit., 1915, pp. 160–174*).—This is a discussion, largely from a chemical standpoint, of the sources of the world's sulphur supply, the production, relative values, and employment of forms more or less adapted to use as fungicides, the employment of miscible sulphur and sulphur pastes, soluble homemade and commercial sulphur preparations, and the compatibility of sulphur with other fungicides.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Laws relating to fur-bearing animals, 1916, D. E. LANTZ (*U. S. Dept. Agr., Farmers' Bul. 783 (1916), pp. 28*).—This is a summary of laws in the United States and Canada relating to trapping, protection, propagation, and bounties.

Canaries: Their care and management, A. WETMORE (*U. S. Dept. Agr., Farmers' Bul. 770 (1916), pp. 20, figs. 5*).—This publication has been prepared to meet requests received for information on the care of birds in sickness and in health.

Shading effect of wire insect cages, H. H. KIMBALL (*U. S. Mo. Weather Rev., 44 (1916, No. 9, pp. 501–506, figs. 3*).—Pyrheliometric measurements are reported which " show that at normal incidence with the wire cloth the wires intercept 0.332 of the solar radiation, or about what we would expect of 16-mesh cloth made of No. 29 wire, American gage."

Relationship between the wetting power and efficiency of nicotin-sulphate and fish-oil-soap sprays, L. B. SMITH (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 9, pp. 389–399, figs. 2*).—This is a report of investigations conducted at the Virginia Truck Experiment Station on 27 one-twentieth acre plats on which peas were sprayed five times and spinach and strawberries once with various mixtures of nicotin sulphate and fish-oil soap for the pea aphid, spinach aphid, and red spider, respectively. The wetting powers as well as the nicotin content of the solutions were determined.

The proportional efficiency of the sprays proved to be similar for each species. " When more than 4 lbs. of soap were used with 10 oz. of nicotin sulphate to 50 gal. of water, there was a loss of both wetting power and efficiency. When more than 8.75 oz. of nicotin sulphate were combined with 5 lbs. of fish-oil soap to 50 gal., a loss occurred in both the wetting power and the efficiency. When nicotin sulphate was used in quantities up to 10 oz. to a 1 : 50 fish-oil-soap solution none of the resultant sprays had an efficiency of more than 75 per cent. Also, when fish-oil soap was used alone in quantities not exceeding 8 lbs. to 50 gal., the highest efficiency of any of the formulas was only a fraction over 75 per cent. It was found that the nicotin content of the solutions remained the same irrespective of the amount of soap used.

" The loss of efficiency due to increasing the concentrations of the solutions is probably caused by a loss of both wetting power and insecticidal value of the soap. The loss of wetting power which occurs when the concentration of the solutions is increased has a stronger tendency to reduce the efficiency of the subsequent solutions if the original solution has an efficiency of 85 per cent or more than it does if the original efficiency is below 75 per cent.

" The actual importance of wetting power is difficult to determine in this case, as the fish-oil soap has insecticidal properties in itself. Where the wetting

power is affected it is probable that the soap is also broken down sufficiently to lose some of its value as an insecticide; hence, both factors must be considered as the cause of the loss of efficiency of some of the more concentrated mixtures."

Cyanid gas for the destruction of insects, with special reference to mosquitoes, fleas, body lice, and bedbugs, R. H. CREEL and F. M. FAGET (*Pub. Health Rpts. [U. S.], 31 (1916), No. 23, pp. 1464–1475*).—Following a review of the literature relating to the subject experiments with cyanid gas and sulphur dioxid are reported in tabular form.

"Cyanid gas is much cheaper than sulphur dioxid for mosquito destruction, costing only one-seventh as much as the latter gas, aside from requiring a much less duration of exposure. . . . For destroying bedbugs, roaches, and body lice sulphur is a cheaper fumigant than cyanid, but the latter possesses obvious advantages in lessened duration of exposure and noninjurious effect on fabrics, furnishings, merchandise, etc."

Some effects of freezing arsenate of lead pastes, R. A. DUTCHER (*Jour. Econ. Ent., 9 (1916), No. 6, pp. 561–566, pls. 3*).—The author finds that the settling properties of some commercial samples of lead arsenate paste are affected by freezing while others are not, that the microscopical appearances of all lead arsenate pastes examined were altered, and that the adhesive properties of lead arsenate pastes may be affected by freezing.

Forty-sixth annual report of the Entomological Society of Ontario, 1915 (*Ann. Rpt. Ent. Soc. Ontario, 46 (1915), pp. 232, figs. 65*).—This report includes the following papers:

Insects of the Season in Ontario (pp. 29–33) and The Imported Willow and Poplar Borer or Curculio (*Cryptorhynchus lapathi*) (pp. 33–40), by L. Caesar; Side Injury and Codling Moth, by E. P. Felt (pp. 40–43); The Home of *Gortyna stramentosa*, by A. F. Winn (pp. 43–48); Insects of Ste. Anne's, Quebec, Season of 1915 (pp. 48–50) and The Occurrence of *Tychius picirostris* on Clover at Ste. Anne's, Quebec (pp. 50–52), by E. M. DuPorte; Observations upon Some of the Predacious and Parasitic Hymenoptera, by Fyles (pp. 52–60); The Leaf-weevil (*Polydrusus impressifrons*) in New York, by P. J. Parrott and H. Glasgow (pp. 60–65); The Green Apple Bug (*Lygus invitus*) in Nova Scotia, by W. H. Brittain (pp. 65–78), noted on page 457; A Capsid Attacking Apples (*Neurocolpus nubilus*), by H. G. Crawford (pp. 79–88); The Founding of the Science of Cecidology, by A. Cosens (pp. 88–93); The Army Cutworm in Southern Alberta, by E. H. Strickland (pp. 93–97); Life Zones in Entomology and Their Relation to Crops, by H. T. Fernald (pp. 97–101); Some Notes Regarding Nose and Other Botflies, by W. Lochhead (pp. 102–108); The Seasonal Prevalence of *Hypoderma bovis* in 1915, Together with Observations on the Terrifying Effect *H. bovis* Has Upon Cattle, and Lesions Produced by the Larva, by S. Hadwen (pp. 108–119), noted on page 482; Progress of Entomology in Canada During 1915, by C. G. Hewitt (pp. 119–123); The Life History of *Chermes cooleyi* in Stanley Park, Vancouver, B. C., by R. N. Chrystal (pp. 123–130); The Cabbage Maggot—Autumn Development in British Columbia (*Phorbia brassicæ*) (pp. 130–139) and The Cabbage Maggot in British Columbia (*P. brassicæ*).—The Natural Control by Parasites and Predacious Insects (pp. 140–145), by R. C. Treherne; Some of the Methods Followed in Nova Scotia in Controlling the Brown-tail Moth, by G. E. Sanders (pp. 147–152); Observations on the Brown-tail and Gipsy Moth Situation in Relation to Canada, by J. D. Tothill (pp. 152, 153); The Work Carried on in the United States Against the Gipsy and Brown-tail Moths, by A. F. Burgess (pp. 153–155); Locust Control Work with Poisoned Baits in Eastern Canada in 1915, by A. Gibson (pp. 156–162); Leaf Rollers At-

tacking Apples, by L. Caesar (pp. 163–178); A Preliminary List of Parasitic Insects Known to Occur in Canada, by R. C. Treherne (pp. 178–193); and The Entomological Record, 1915, by A. Gibson (pp. 194–230).

Insect pests [in Sitka district], J. P. ANDERSON (*Alaska Stas. Rpt. 1915, pp. 41, 42*).—It is pointed out that the cabbage maggot is the worst insect enemy of horticultural crops at the Sitka Station, due to its attacking all the cruciferous vegetables. Fifteen or 20 per cent of the apples grown at the station were more or less injured during the year by what is thought to be *Argyresthia conjugella.* A green aphis, troublesome in the greenhouse, was satisfactorily held in check by occasional fumigation with a nicotin paper.

Report of the entomologist for the year 1915–16, A. H. RITCHIE (*Ann. Rpt. Dept. Agr. Jamaica, 1916, pp. 31–34*).—The aleyrodid *Aleurocanthus woglumi* is reported to have continued its spread in Jamaica, two of the largest citrus groves on the island having been attacked for the first time. The Florida spray, consisting of Diamond paraffin oil and whale-oil soap, is said to act as an excellent control measure. It is stated that this pest may also be controlled by transferring to citrus trees nests of an undetermined black ant which are naturally built in the forks of branches of the logwood.

Among the enemies of cacao mentioned are the red-banded thrips (*Selenothrips rubrocinctus*), which causes defoliation and, in the drier localities or during dry periods of the wetter northern estates, rusting of the pods. The emulsion above mentioned (1:50) or blackleaf 40 (1:2000), with 3 lbs. of soap per 100 gal. of spray added as a spreading agent, has been found to be the most satisfactory.

In addition to citrus and cacao pests, mention is also made of the insect enemies of the mango and field crops.

Some phases of the locust problem, C. P. LOUNSBURY (*So. African Jour. Sci., 12 (1915), No. 2, pp. 33–45*).—A discussion of the locust problem, particularly as related to South Africa.

The cockroach: Its destruction and dispersal, J. J. H. HOLT (*Lancet [London], I, 1916, No. 23, pp. 1136, 1137*).—The author has tested the effect of liquid volatile bodies, aromatic oils, coal-tar and paraffin derivatives, dusting powders, and food poisons on the cockroach.

The results of the experiments as a whole seem to indicate "that many of the substances which have been supposed to kill the cockroach have really acted by driving it away and so leading to its disappearance. Such gregarious migrations have been observed but have hitherto been otherwise explained. For quick destruction stoving with bromin or sulphur dioxid is apparently best. For domestic application the daily use of creosote, wood naphtha, or the oil of rosemary, eucalyptus, or citronella placed near the haunts of the cockroaches for two or three weeks should effectually disperse them. Where these are inadmissible on account of their smell, odorless dusting powders may be used. Of these sodium fluorid was found to be the most effective. It is also cheap and keeps indefinitely."

The green apple bug (Lygus invitus) in Nova Scotia, W. H. BRITTAIN (*Ann. Rpt. Ent. Soc. Ontario, 46 (1915), pp. 65–78, figs. 14*).—The observations and experiments during 1915 with *L. invitus* have been summarized as follows:

"The green apple bug is one of the most serious pests of apples and pears in Nova Scotia, though hitherto, owing to its elusive habits, it has not been recognized as such. It is the cause of 'woody pears' and one of the causes of gnarled, twisted apples. It is the most common cause of the continued failure to bear of Nonpareil and certain other varieties of apple. It attacks not only the fruit but also the foliage, stems, and blossoms of apples and pears, and in the adult stage has been known to attack plums.

"The nymphs are frequently caused to drop from the trees by high winds, heavy rains, sprays, etc., and may then either reascend the tree or feed upon the weeds, grass, or clover at its base. Though capable of coming to maturity on the foregoing plants, in the adult state they invariably seek the apple and pear to deposit their eggs

"In control not only must the tree be thoroughly sprayed to kill as many bugs as possible, but those which have fallen to the ground must be kept there without food until they starve. If the orchard is in sod, or the weeds are abundant, the insects on reaching the adult state will fly to the trees and continue their work. The orchard must, therefore, be kept in a state of clean cultivation, until all the insects have reached the adult state, which will be at the end of the first week in July. The trees must be banded with tree tanglefoot to prevent the reascent of the insects that have fallen to the ground.

"The trees must be properly pruned so that all parts can be readily reached by the spray. Apple trees should be sprayed with blackleaf 40 in the strength of 1 pint to 100 gal., just before the blossoms open and again after they fall; pear trees just after the petals fall and again five days later. A very heavy drenching spray must be applied. The insects are much more easily controlled on pears than on apples, so that with light infestations in this tree spraying alone should be sufficient to control the pest."

Studies of life histories of froghoppers of Maine, H. Osborn (*Maine Sta. Bul. 254 (1916), pp. 265–288, pls. 6, figs. 6*).—Under the heading of meadow froghoppers the author reports studies made of the meadow froghopper (*Philænus spumarius*), the grass-feeding froghopper (*P. lineatus*), and the angulated froghopper (*Lepyronia quadrangularis*); and under the heading of bush and tree froghoppers, the parallel spittle insect (*Aphrophora parallela*), the alder spittle insect (*Clastoptera obtusa*), the dog-wood spittle insect (*C. proteus*), *C. xanthocephala*, and *Philaronia bilineata* are considered.

It is pointed out that while *P. spumarius* occurs almost entirely on plants other than grasses, *P. lineatus* occurs almost exclusively on grasses, especially timothy and redtop. *P. spumarius* is widely distributed in the eastern United States as well as in Europe. *P. lineatus* has a wide range in the northern hemisphere, occurring over a wide territory in Europe and North America, but in the United States appears to be distributed especially through the northern portion, occurring from Maine to the Rocky Mountains. The life histories of these species agree very closely, so that one statement will almost answer for the two.

Where the buttercup is present *P. spumarius* seems to gather on it in preference to other plants, though clover is apparently nearly as much affected and there is no doubt that the hoppers must be a distinct factor in the reduction of the formation of the perfect clover heads. The eggs are believed to pass the winter in the meadows where the nymphs are observed in summer, and are probably deposited in the stems of their various food plants or possibly in dead stems or leaves at the surface of the ground. The larvæ hatch in early summer and the nymphs develop rather rapidly, only adults being observed from the middle of July. A frequent rotation from grass to some other crop is thought to be the most effective means of controlling *P. lineatus*. Neither *L. quadrangularis* nor any of the bush and tree froghoppers appears to be of much economic importance.

Macrosiphum granarium, the English grain aphis, W. J. Phillips (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 11, pp. 463–480, pls. 3, fig. 1*).—As stated by the author, the object of this paper is primarily to record some details of the life history of *M. granarium* (with which *Aphis avenæ* is synonymous) and to discuss the interesting color variations in relation to the sexes.

M. granarium is a familiar pest of long standing, widely disseminated throughout the United States wherever small grains are cultivated, and will live and thrive on a number of the wild and cultivated grasses. Observations of its life history and habits made at La Fayette, Ind., and Charlottesville, Va., are recorded, and a tabular report is given of a line of 17 generations at Richmond, Ind., in 1908.

The eggs begin to hatch during the last week in March in the latitude of La Fayette, and continue hatching through the first week in April. Eggs were obtained in Richmond in the fall of 1908 but none hatched the following spring, and of eggs secured in the fall of 1909 at La Fayette only one hatched. From hundreds of eggs secured in the fall of 1910 only about 15 or 20 hatched.

As is common with Aphididæ in general in the latitude of La Fayette, this species reproduces parthenogenetically until October, when the sexes appear and eggs are deposited. While no oviparous females were observed in the fields, the presence of the males indicates that the sexes occur normally on the small grains and on blue grass in the fall. Viviparous females have been carried through the winter out of doors in breeding cages at La Fayette and Charlottesville and have been found on the small grains throughout the fall, in the winter, and again in the early spring, so they doubtless pass the winter both in the egg and as viviparous females in the Northern States. It is doubtful whether eggs and stem mothers normally occur much south of latitude 35° unless it is in higher altitudes.

The aphids remain on the leaves of wheat and other small grains until the heads are formed and then cluster around the tender kernels, sucking the rich sap. Just before harvest, when the plant tissues become hard and tough, all immature individuals become winged and migrate to some of the grasses, where they remain until volunteer grain and fall wheat put in their appearance.

Of the numerous parasitic and predacious enemies of this aphid *Aphidius nigripes* is said to be the most efficient.

The specific effects of certain leaf-feeding Coccidæ and Aphididæ upon the pines, K. B. Brown (*Ann. Ent. Soc. Amer., 9 (1916), No. 4, pp. 414–422, pls. 2*).—The author's studies show that the damage to the needles of pine trees by aphid feeding is "(1) from the honeydew fungus, which makes the trees unsightly and interferes with the process of photosynthesis or food manufacture in the needles by shutting off part of the light; (2) by discolored areas from which food has been taken and which have been whitened by admission of air to the cells; (3) by the making of conspicuous, infiltrated spots and causing gum exudation; and (4) inconspicuous damage by the great number of piercings and suckings. This, though usually invisible, is probably more important than the first three taken together.

"The damage to pines by the coccids studied is due to sucking and the enzym action of the saliva injected to assist in this process. The damage consists of the destruction of chlorophyll-bearing cells with a subsequent whitening of the needles. This is followed by the death of the needles in some cases, or occasionally by the production of infiltrated spots that while conspicuous are not of great importance."

Life history of the velvet bean caterpillar (Anticarsia gemmatilis), J. R. Watson (*Jour. Econ. Ent., 9 (1916), No. 6, pp. 521–528, pls. 2, figs. 2*).—Substantially noted from another source (E. S. R., 35, p. 854).

Concerning the oviposition of infertile eggs and parthenogenesis in the silkworm, A. Lécaillon (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 6, pp. 234–236*).—The oviposition of eggs by infertile females occurred very irregularly. Certain infertile eggs may undergo change in color resembling those that are fertile.

The cochylis, H. FAES and F. PORCHET (*In La Station Viticole Cantonale Vaudoise de Lausanne dès Sa Fondation à Son Transfert à la Confédération Suisse, 1886–1916. Lausanne: Dept. Vaud. Agr., 1916, pp. 56–76*).—This article deals with the manner of combating the caterpillar, the pupa, and the adult, the use of natural enemies in dealing with the cochylis, etc. A discussion of *Eudemis botrana*, etc., follows.

Reducing malaria by reducing the number of Anopheles within buildings, J. ZETEK (*Ann. Ent. Soc. Amer., 9 (1916), No. 3, pp. 275–283, figs. 3*).—The author's observations here reported, which are largely applicable to temporary construction camps in malarious regions, show that screening, traps, and mosquito catching indoors will suffice to keep malaria at a very low rate.

Ronald Ross and the prevention of malarial fever, W. C. GORGAS and F. H. GARRISON (*Sci. Mo., 3 (1916), No. 2, pp. 133–150, pl. 1*).—Following a historical review of the work relating to the transmission of malaria by mosquitoes, the authors describe at length that of Ross and his demonstration of the rôle of Anopheles in the transmission of malarial parasites.

Syrphidæ of Maine, C. L. METCALF (*Maine Sta. Bul. 253 (1916), pp. 193–264, pls. 9, fig. 1*).—The first part of this bulletin consists of a general account of the Syrphidæ and particularly of the structure of the larvæ of the several types, namely, the aphidophagous, boring, short-tailed filth inhabiting, long-tailed (rat-tailed) filth inhabiting, and microdon types. The economic importance of the larvæ, including their beneficial and injurious habits, the economic importance of the adults, and practical measures for increasing the number of Syrphidæ, are next discussed. A list of 20 species of Syrphidæ reared from eggs in 1915, nine of which have apparently not previously been described in the immature stages, and a list of 39 species of Homoptera attacked by Syrphidæ in Maine as observed in 1915 are next given. Descriptions of life stages and life histories of ten Maine forms studied by the author, together with artificial keys to the known larvæ and pupæ of Syrphidæ, make up the main part of the work. The species thus considered and illustrated are *Pipiza pisticoides*, *Melanostoma mellinum*, *Sphærophoria cylindrica*, *Allograpta obliqua*, *Syrphus americanus*, *S. torvus*, *S. nitens*, *Didea fasciata*, *Tropidia quadrata*, and *Syritta pipiens*.

A glossary is given of the new or unusual terms used, together with a bibliography of 66 titles.

The attraction of Diptera to ammonia, C. H. RICHARDSON (*Ann. Ent. Soc. Amer., 9 (1916), No. 4, pp. 408–413*).—Substantially noted from another source (E. S. R., 36, p. 156).

A contribution to the knowledge of dipterous larvæ and pupæ, J. C. H. DE MEIJERE (*Zool. Jahrb., Abt. System. Geogr. u. Biol. Tiere, 40 (1916), No. 3–4, pp. 177–322, pls. 11*).—This paper describes the larval and pupal stages of some 25 forms.

The transmission of disease by flies, E. A. SWEET (*Pub. Health Rpts. [U. S.], Sup. 29 (1916), pp. 20, pls. 2, figs. 2*).—A general discussion of flies and the rôle which they may play in the transmission of disease, their enemies, and eradicative measures.

Sciara maggots injurious to potted plants, H. B. HUNGERFORD (*Jour. Econ. Ent., 9 (1916), No. 6, pp. 538–549, pls. 2*).—"The life history of *Sciara coprophila* requires a period of from 24 to 32 days. The egg stage occupies 6 days, the maggot stage 12 to 14 days or longer, the pupa stage 6 days, and the adults have lived under laboratory conditions about a week.

"The maggots, though omniverous feeders, are injurious to potted plants through their feeding upon the roots and root hairs. Soils that are moist and rich in manure or dried blood attract the flies and lead to the laying of large

numbers of eggs in these favored situations, the result being that the plants growing in soils of this character are seriously damaged.

"The maggots, though resistant to most insecticides, quite readily succumb to drying. Thus, by letting the soils dry out occasionally, little trouble will be experienced. Where a serious infestation occurs, a judicious drying out of the soils, use of dry sand on top of the dirt, and trap pots of dried blood and earth and sprouting grain used to attract egg laying will effectually control the pest. The maggots and eggs in these trap pots should be destroyed about every two weeks by submerging in boiling water.

The occurrence of two annual generations of the elm leaf beetle (Galeruca luteola) and the manner in which they follow one another, A. Lécaillon (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 13, pp. 481–484*).—In the region of Toulouse the eggs of the elm leaf beetle are deposited on elm leaves during a period of four months, or from the first of May until the first of September. The first generation occurs during May and June, followed by the second during July and August. It is thought possible that the adults of the second generation do not complete their oviposition before hibernating and that oviposition is continued the following spring, and also that certain adults of the third generation may commence to oviposit before hibernation commences.

The dock false worm: An apple pest, E. J. Newcomer (*U. S. Dept. Agr. Bul. 265 (1916), pp. 39, pls. 2, figs. 6*).—This pest, the larva of an allantine sawfly (*Ametastegia glabrata*), long known both in Europe and America as an enemy of dock, sorrel, and knotweed, has acquired the habit of boring into mature apples on the tree in September and October to hibernate, thereby destroying their market value. With one exception, no evidence of injury was found that occurred before the apples had practically stopped growing. Apples frequently have three or four, or sometimes even eight, holes in them of varying depths, but contain only one or two worms, or often none at all. In the present paper the author reports at length upon studies of its biology and remedial measures, much of the data being presented in tabular form.

The dock false worm is found all over Europe and in Canada and the northern part of the United States, from the Atlantic to the Pacific. There are four generations annually, each occupying about a month, except the fourth, the larvæ of which hibernate and complete their development the following spring. Only the larvæ of the last generation are known to bore into apples. The ichneumonid parasites reared from overwintering material represent seven distinct species, namely, *Epiurus pterophoræ*, *Spilocryptus* sp., *Ænoplex* sp., *Bathymetis* sp., *Bathythrix* sp., and two species of Cratocryptus. Of 268 eggs observed at Wenatchee, Wash., from July 26 to September 8, 11.9 per cent were parasitized by *Trichogramma minuta*. As regards remedial measures, it is pointed out that protection may be afforded by keeping the orchard free of dock and other food plants, or where this is impossible by banding the trees with cotton or some sticky substance the latter part of August, leaving the bands on until after the fruit is harvested.

A list of 37 references to literature on the subject is included.

Observations upon some of the predacious and parasitic Hymenoptera, Fyles (*Ann. Rpt. Ent. Soc. Ontario, 46 (1915), pp. 52–60, figs. 2*).—This paper includes a list of 70 species of Ichneumonidæ taken by the author in the Province of Quebec.

Syntomaspis druparum, the apple-seed chalcid, R. A. Cushman (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 11, pp. 487–502, pls. 4, figs. 8*).—This is a report of biological studies of *S. druparum* carried on during parts of the seasons 1914 and 1915 at the laboratory at North East, Pa., and in the field throughout its range, which includes the northern tier of States from Vermont

to Michigan. Reports of observations of this insect in New York by Crosby have been previously noted (E. S. R., 28, p. 654).

The only externally visible effect of infestation is caused by the oviposition puncture, which after a few days appears as a minute scar situated in a small, shallow dimple and from which a discolored line extends to the seed. It is pointed out that frequently injury caused by other insects, particularly the apple red bugs, is attributed to the apple-seed chalcid because at the time the injury is noted it is the only insect present. The author has found nearly every variety of natural fruit, except the largest, to be more or less generally infested at practically every point visited. The Lady apple is apparently the only cultivated variety subject to very serious attack, the ordinary commercial varieties never being infested except in run-down or neglected orchards or when fruit is stunted by the overloading of trees or by the attack of some other insect or disease.

In observations at North East in 1914 the adult did not appear in numbers until after the middle of June, the heaviest emergence occurring during the week of June 22 to 29 and the last on July 5. Oviposition may occur within two days after issuing from the seed and may continue as long as 26 days. The eggs have been observed to hatch in from six to ten days. In 1915 the earliest hatching took place on the seventh day after oviposition, the earliest first molt on the sixteenth day, and the earliest second molt on the twenty-first day, the earliest third molt on the twenty-fifth day, and the earliest last molt on the twenty-ninth day, and the first larva to consume the entire seed contents had done so on the forty-ninth day. The last larva to finish feeding required 57 days. It is said to be not uncommon to find six or seven very young larvæ in a single seed, but on only one occasion was more than one of the fifth instar found within a single seed, the surplus larvæ being killed and eaten by the one which ultimately matures, usually before the fourth instar is reached.

When the larva has consumed its total food supply it very shortly assumes what appears to be the hibernating form. Not all of the larvæ from eggs of a given season finish their development and emerge as adults the following spring; a large percentage (some 55 per cent) of them remain as larvæ within the seeds until the second spring. The larvæ begin to pupate during the latter half of May, the latest pupation apparently taking place from three weeks to a month later. The pupal period is of about four weeks' duration.

Thus far no specific enemies of the apple-seed chalcid have been observed. Control measures include the destruction of all wild seedling apples and wild crab-apple trees in the neighborhood and of all drop fruit and culls for two seasons. Where waste fruit is converted into cider, the pomace should be destroyed.

An efficacious endoparasite of Chrysomphalus dictyospermi, A. Berlese and G. Paoli (*Redia, 11 (1916), No. 1–2, pp. 305–307, figs. 2*).—A new parasite received from Madeira, here described as *Prospaltella lounsburyi,* is said to attack *C. dictyospermi.* About 60 per cent of the nymphs and 40 per cent of the adults in the material examined were parasitized.

FOODS—HUMAN NUTRITION.

Fats and their economical use in the home, A. D. Holmes and H. L. Lang (*U. S. Dept. Agr. Bul. 469 (1916), pp. 27, figs. 2*).—This bulletin summarizes information on the general nature of fats and their digestibility and place in the diet, and describes briefly the different animal and vegetable fats now available for food purposes. Suggestions are given regarding the economical selection of fats and their use for table and culinary purposes. There is also in-

cluded a discussion of the utilization of waste fats and methods of rendering and clarifying fats in the home. To secure economy in the use of fats, emphasis is laid upon the desirability of choosing the fats which are best suited for the purpose in question, of avoiding extravagant use of fats, of the need of care of fats to avoid waste through spoilage, and of the saving and utilization of waste fats, whenever the time and labor involved do not exceed the value of the product.

Results are also reported of preliminary studies made by the authors to determine the temperatures most satisfactory for deep frying in fats. It was found that there was a definite temperature for each fat at which the batter fried soaked the smallest quantity of fat and was at the same time satisfactorily cooked. The optimum temperature was about 360° F. for beef fat, 350° F. for lard, and 390° F. for cottonseed, coconut, and peanut oils. A lowering of the temperature 20° in the case of animal fats and 40° F. for vegetable fats resulted in increasing the quantity of fat absorbed by the batter approximately 25 per cent. These experiments indicate that for successful deep frying vegetable fats should be heated from 30 to 40° F. higher than the animal fats.

Methods of preserving and manufacturing meat products, A. CASSAMAGNAGHI (*Métodos de Conservación y Elaboración de Carnes. Montevideo: National Press, 1916, pp. 23*).—Detailed descriptions are given of the methods used in preserving meats exported from Uruguay. Both chilling and freezing processes are described, as well as methods of preserving by heat and by pickling. It is recommended that an inspection service be established, that the use of meat which has been thawed in the open air be forbidden, and that preserved meats be classified according to the processes which have been used in their preservation.

The food value and uses of poultry, HELEN W. ATWATER (*U. S. Dept. Agr. Bul. 467 (1916), pp. 29, figs. 2*).—This bulletin, which summarizes general and experimental data regarding the food value, selection, and use of poultry, is a revision of an earlier publication on this subject (E. S. R., 15, p. 701). The material has been brought up to date and some of it is presented in a different form.

The sanitation of the shellfish industry, H. S. CUMMING (*Jour. Amer. Med. Assoc., 67 (1916), No. 27, pp. 2001–2004*).—The author discusses from a sanitary standpoint the development of the shellfish industry and describes efforts to control the sanitary condition of shellfish. Several suggestions for improving the sanitary quality of shellfish are given.

A preliminary chemical study of the rices of Bihar and Orissa, J. N. SEN (*Agr. Research Inst. Pusa Bul. 62 (1916), pp. 20, pl. 1*).—The results of this investigation show that the composition of these rices is in the main similar to that of other rices, approaching those of Burma more closely than others.

"With an increase in the albuminoid content of husked rice there is a diminution in the quantity of soluble carbohydrates. On the other hand, the low content of alubuminoids is associated with increased amounts of soluble carbohydrates. When expressed as percentages of the dry matter the sum of the albuminoids and soluble carbohydrates generally lies between 94 and 95.

"The amount of phosphoric acid in a sample of husked rice is just a little less than half of the minerals present. The amount of potash is about half the quantity of phosphoric acid.

"When rice undergoes polishing it loses much of the oil, or other extract, and the minerals, besides some albuminoids. In the outer layers removed during this process the concentration of phosphoric acid is greater than that of potash, although there is relatively more of both these constituents in the bran than in the polished grain. The nitrogen is more uniformly distributed.

"No relation can at present be traced between the chemical composition and the accepted culinary properties of the different rices."

There is also included a discussion on rice as an article of diet.

North Dakota wheat for 1916, E. F. LADD (*North Dakota Sta. Bul. 119 (1916), pp. 51–61, pl. 1*).—This bulletin constitutes a preliminary report on the milling and bread-producing qualities of the wheat crop for 1916. The results are reported of milling and baking tests on the different grades of wheat, and figures are given showing the receipts per bushel of the various milled products in the case of each grade.

The results of the baking tests showed that the baking quality of all the wheats was good and in general they gave large loaf volume and good texture, although they were not always standard in color. The percentage of flour was found to be much higher for the lower grades of wheat than is generally assumed, and the loaf volume for the lower grades was higher than for higher grades, while the color averaged the equal of the minimum standard for straight flours. Previous work (E. S. R., 32, p. 634) was continued by taking data as to a carload of wheat of the several grades and following it through from the farmer to the consumer. An attempt was made to show specifically what each grade would be valued at according to the systems of grading and marketing prevailing in the several localities. The figures presented indicated that from an investment in low-grade wheat there was a greater total income than for the best wheat on the market.

Science of baking business with special reference to yeast foods, R. M. ALLEN (*Nat. Baker, 21 (1916), No. 250, pp. 45, 46, 48, 50–52, 54–56*).—This article reviews the experimental work which has been done along the lines of fermentation, with special reference to the loss of flour due to fermentation; the nutritive value of yeast; and the conservation of dough materials which can be brought about by the addition of various mineral salts.

Experiments in bread making from different kinds of rye, J. JENSEN and E. H. LUDVIGSEN (*Tidsskr. Planteavl, 23 (1916), No. 2, pp. 185–232*).—As the result of the experiments with Bretagne and Petkus rye here reported, the following conclusions are drawn:

In the case of the eight samples used, bread of good quality was obtained and not much difference noted in the composition of the raw materials. With the same content of water in the rye no difference was noted in the weight or quality of bread. In the making of the dough the flour from very dry rye took up much more water than that from the less dry samples. The water content in freshly baked bread was essentially the same in all cases, about 36 to 37 per cent. A very good and tasty bread was obtained from rye, after wintering, with a water content of from 16 to 18 per cent.

Bread as a food.—Changes in its vitamin content and nutritive value with reference to the occurrence of pellagra, C. VOEGTLIN, M. X. SULLIVAN, and C. N. MYERS (*Pub. Health Rpts. [U. S.], 31 (1916), No. 15, pp. 935–943*).—As the outcome of some studies on the cause of pellagra in Spartanburg County, S. C., the authors call attention to the changes in the composition of corn and wheat flours which have resulted from the introduction of the roller process, especially the loss of vitamins. They state that laboratory investigations showed that while the corn meal and wheat flour made by the old-fashioned process of grinding the whole grain contained practically all of the vitamins of the whole grain, the highly milled products were deficient in these substances. It was also found that "fowl, the classical experimental animal for the physiological estimation of the vitamin content of foods, will live in perfect health for many months on an exclusive diet of wheat, corn, whole-wheat flour, or so-called 'water-ground' corn meal. If these animals are fed, however, on highly

milled products, they will die within a month or two of polyneuritis, a disease very similar to beri-beri."

As it is impossible to determine the vitamin content of cereal products by isolation of these substances from the natural foods, the authors suggest the use of the total phosphorus content as a fairly accurate index of the relative amounts of vitamins present. While this method does not yield absolute values of the vitamin content of cereal products, it is proposed provisionally for wheat flour, corn meal, and hominy, that "for corn products the minimum P_2O_5 content should not be below 0.5 per cent, that of wheat flour not lower than 1 per cent."

Attention is called to the use of baking soda in the preparation of bread as a factor involved in the reduction of the vitamin content of bread, especially corn bread. The authors state that when sodium bicarbonate is used as a leavening agent the high temperature of the oven liberates carbon dioxid from the sodium bicarbonate and the latter is transformed into sodium carbonate. Experiments by the authors and others have shown the destructive action of alkalis on vitamins, which lose their physiological activity when exposed to alkalis, especially at high temperatures. It is stated that "corn bread made from old-fashioned (whole) corn meal, sweet milk, and soda, when forming the exclusive diet of chickens, leads to symptoms of polyneuritis, whereas corn bread prepared from corn meal, sweet milk, and salt (NaCl) does not give rise to any symptoms, and fowls seem to live in perfect health. Chickens which have developed polyneuritis on the corn bread made with sweet milk and soda are cured by the administration of vitamins prepared from various foods. Hence . . . [it may be concluded] that corn bread prepared by means of baking soda without the addition of buttermilk is deficient in certain essential accessory foods (vitamins) and that this deficiency is due to the destructive action of the alkali (baking soda) on the vitamins which were originally contained in these foods."

If, however, sour milk or tartaric acid is combined with the baking soda to neutralize its alkalinity, the use of baking soda is deemed harmless. The authors also state that while the use of baking soda without sour milk will not always prove injurious, bread so made is undoubtedly deficient in vitamins, and when the other dietary components are also deficient in vitamins the composition of bread made with baking soda without the use of sour milk accentuates this dietary deficiency and may lead to an impairment of health.

Among the factors stated as playing a rôle in the reduction of the vitamin content of the diet of the people of Spartanburg County are the decrease in the consumption of the more expensive foods, such as meat, eggs, and milk, which are rich in vitamins and efficient in the prevention and treatment of pellagra; the increase in the consumption of highly milled corn meal and wheat flour; and the use of baking soda in the preparation of bread and its addition to beans and other foods to soften them and shorten the time of cooking.

A study of the dietary conditions of certain communities showed "that a large proportion of the people, especially in mill villages, live on a diet which is deficient from the point of view of its vitamin content. Wheat biscuits made from highly milled wheat flour and corn bread made with baking soda without the addition of buttermilk are the staple articles of diet among the people, and . . . [families were found] in which these foods represented about three-fourths of the entire diet. The fact that the above-mentioned influences, which have undoubtedly reduced the vitamin content of the diet, made themselves felt a relatively short time before the rapid increase in the pellagra in-

cidence in this section of the country furnishes considerable evidence in favor of the vitamin-deficiency theory of pellagra."

Bread as a food (*Pub. Health Rpts.* [*U. S.*], *31* (*1916*), *No. 33, p. 2205*).—In this supplementary note to the above article it is stated in part that the data reported in that article were "designed to demonstrate primarily that when a diet poor in essential food elements aside from cereals was constantly used, it appeared likely that if the carbohydrate element contained a liberal amount of the accessory food substances known to be contained in whole grains, the probability of pellagra developing was less than when the starchy element of food was deficient in these substances.

"From the broad view of nutrition it is very probably immaterial what kind of flour is used in making bread provided that an adequate mixed diet is consumed which will supply sufficient of the essential dietary components outside of the cereals contained in the diet."

Evaporated fruit and vegetables, A. McGill (*Lab. Inland Rev. Dept. Canada Bul. 352* (*1916*), *pp. 25*).—This bulletin reports the results of the inspection of of 180 samples of dried fruits and vegetables. In the case of apples, apricots, etc., determinations were made of the amount of sulphur dioxid present in each sample.

Coconut products and other substitutes for butter (*Sci. Amer. Sup.*, *82* (*1916*), *No. 2129, p. 265*).—In his report to the Council of Hygiene, L. Lindet treats of food fats, including butter and its substitutes and different oils with special reference to prevailing conditions in France. He states that in the south of France cooking is done almost exclusively with olive oil, peanut oil, cottonseed oil, and the like. In reference to substitutes for butter chief interest outside of margarin lies in the use of coconut oil or grease. Within the last few years such products have been introduced under the names of "vegetaline," "cocose," etc. The oil, which is extracted from the copra in France, gives a fat product which, after being chemically treated and deodorized, has a melting point of 25 to 26° C. (77 to 78.8° F.) as compared with 33 to 35° for butter. This is corrected by the addition of fats of higher melting point, such as karité, mowhra, or the more solid parts of cottonseed oil.

Coconut toddy in Ceylon, K. C. Browning and C. T. Symons (*Jour. Soc. Chem. Indus.*, *35* (*1916*), *No. 22, pp. 1138–1142*).—Data are reported regarding the method of drawing, uses, processes of treatment, and composition of so-called toddy or palm juice as drawn from the coconut palm (*Cocos nucifera*) in Ceylon. The juice is used for the production of crude sugar, as a beverage, and for the distillation of a potable spirit.

Composition of Hungarian wines, M. Vuk (*Kisérlet. Közlem.*, *19* (*1916*), *No. 2, pp. 289–298*).—The results are reported of the analysis of a number of samples of Hungarian wines from the pressing of 1914, and statistics are given regarding the production and export of these products.

Mace, A. McGill (*Lab. Inland Rev. Dept. Canada Bul. 349* (*1916*), *pp. 13*).—The work of other analysts showing the composition of mace is reviewed, and the author reports the results of the examination of 175 samples of mace. These included samples of known origin, samples essentially true mace, samples mixed with true and wild mace, and samples variously adulterated. Standards are also outlined for mace.

Boric acid occurring naturally in some foods, A. H. Smith (*Ohio Jour. Sci.*, *17* (*1916*), *No. 2, pp. 66–68*).—Data are reported regarding the amount of boric acid found in dried fruits (dates, peaches, apricots, prunes, figs, and raisins) and in some samples of sausage. Dates and prunes contained the largest percentage of boric acid, the quantities in the other fruits and in the sausages being insignificant, although measurable.

[Drug analyses], E. F. LADD and ALMA K. JOHNSON (*North Dakota Sta. Spec. Bul., 4 (1916), No. 9, pp. 195–242*).—This bulletin reports the results of the examination of a large number of miscellaneous patent medicines, toilet preparations, etc.

Annual report of the state chemist of Florida, R. E. ROSE (*Fla. Quart. Bul. Dept. Agr., 27 (1917), No. 1, pp. 213*).—This bulletin reports the results of the examination of 1,511 samples of foods, drugs, citrus fruits, fertilizers, and feeding stuffs made during the year 1916.

Sixteenth annual report of the state food commissioner of Illinois, W. S. MATTHEWS (*Ann. Rpt. State Food Comr. Ill., 16 (1915), pp. 181, fig. 1*).—This publication reviews the work of the department for the year 1915 and reports data regarding 6,513 samples of miscellaneous food products, as well as the results of inspections of creameries, food-manufacturing establishments, etc. The text is given of standards for foods in force January 1, 1916.

Report of the chief of the bureau of inspection on the enforcement of the pure food law, A. M. G. SOULE (*Agr. of Maine, 1915, pp. 149–177, pls. 3*).—The results are reported of the examination of samples of agricultural seeds, commercial feeding stuffs, commercial fertilizers, fungicides, insecticides, drugs, and foods. Inspections were made of bakeries, bottling establishments, canning factories, etc.

Report of deputy state sealer of weights and measures, E. A. RUSS (*Agr. of Maine, 1915, pp. 128–148, pls. 3*).—The work of the bureau of weights and measures during the year 1915 included the testing of a large number of scales, weights, dry and liquid measures, automatic pumps, etc., and an educational campaign.

Homemade fireless cookers and their use (*U. S. Dept. Agr., Farmers' Bul. 771 (1916), pp. 16, figs. 5*).—Directions are given for building a fireless cooker from materials found in the home or easily obtainable, together with suggestions for the most satisfactory use of the fireless cooker. Recipes for the preparation of different foods in the fireless cooker are included.

Is vegetarianism based on sound science? M. HELEN KEITH (*Sci. Amer. Sup., 82 (1916), No. 2135, pp. 358, 359*).—The relative advantages and disadvantages of the vegetarian diet are considered in the light of recent experimental data.

The general conclusion drawn by the author from this evidence is that a meat-free diet is not so safe as a diet containing meat. While in some respects animal and vegetable food constituents are equivalent and replaceable, the selection of a suitable variety from these sources requires special care and probably special attention to the manner of preparation. "It may be said emphatically that the narrow restriction of the diet to cereals leads to serious injury."

The action of sodium citrate and its decomposition in the body, W. SALANT and L. E. WISE (*Jour. Biol. Chem., 28 (1916), No. 1, pp. 27–58*).—In the experiments reported a study was made of the presence of citrate in the blood of a number of animals (dogs, cats, rabbits, etc.) when administered by mouth or subcutaneously; the rate of disappearance of citrates from the circulation when injected intravenously; the oxidation of citrates in different animals; and numerous observations on toxicity. The results may be briefly summarized as follows:

Sodium citrate disappeared rapidly from the circulation after intravenous injection, but this was retarded when the doses were repeated, oxidation and elimination being probably much slower when large doses were given at frequent intervals. The amount of citrate eliminated in the urine after subcutaneous injection averaged 12 per cent in the case of rabbits and about 30 per cent in the case of cats.

"The toxicity of sodium citrate when given intravenously depends upon the rate of injection, the fatal dose varying between 0.4 and 1.6 gm. per kilogram (approximately), but about 70 mg. may produce symptoms. Only large amounts of citrate are toxic when ingested. Large doses given subcutaneously showed cumulative action. . . . The toxicity of sodium citrate depends upon the rate of its oxidation in the body, being more toxic for animals in which larger quantities are eliminated unchanged."

Elimination of malates after subcutaneous injection of sodium malate, L. E. WISE (*Jour. Biol. Chem., 28 (1916), No. 1, pp. 185–196*).—A study was made of the elimination of malates following the subcutaneous injection of sodium malate in the case of laboratory animals (rabbits and cats). The small amounts of malic acid in the urine were estimated by a modification of the Ohta-Yoder method (E. S. R., 26, p. 710), the modification consisting in saturating the urine with powdered uranyl acetate, instead of adding saturated solutions of the reagents.

The experiments showed that sodium malate injected subcutaneously in moderate doses was incompletely destroyed by rabbits and cats, from 3 to 21 per cent being eliminated in the urine in the case of rabbits and 17 to 41.5 per cent in the case of cats. Subcutaneous injections of sodium malate in amounts not exceeding 1 gm. per kilogram of body weight were not followed by nephritis or glycosuria. No symptoms were observed in the case of rabbits, and at most only a slight temporary depression in the case of cats. The injection of large amounts (3.3 gm. per kilogram of body weight) of sodium malate was followed by toxic symptoms, although no effort was made to determine the lowest limit of toxicity.

The behavior of tartaric acid and the tartrates in the animal organism, M. KAHN (*Biochem. Bul., 4 (1915), No. 14–15, pp. 398–409*).—A summary and digest of experiental data.

ANIMAL PRODUCTION.

Annual review of investigations in general biology, compiled by Y. DELAGE ET AL. (*Ann. Biol. [Paris], 19 (1914), pp. XXXVI+588*).—This continues the bibliography previously noted (E. S. R., 33, p. 167), presenting data as to the literature published in 1914, with abstracts of the more important articles.

Animal production, VON OLLECH (*Jahresber. Landw., 29 (1914), pp. 180–290*).—These pages contain abstracts of German articles on animal production and dairying published during 1914, most of which have been noted from other sources.

The pituitary gland.—Its effect on growth and fission of planarian worms, ROSALIND WULZEN (*Jour. Biol. Chem., 25 (1916), No. 3, pp. 625–633*).—From experiments reported, the author concludes that a diet of pituitary substance increases the rate of fission in planarian worms regardless of the portion of the gland used or the age of the worms. The growth of the worms is accelerated by a diet of pars glandularis and pars intermedia, provided the diet is begun when the worms are very small. There is indication of a distinction between the substance which produces fission and that which produces growth, and that "the growth-producing substances of pars glandularis and pars intermedia leave the gland by way of the blood vessels of pars glandularis."

The results of some feeding experiments on chicks with the gland showed inhibition in the pituitary-fed chick during the early growth period. This result confirms that of Pearl previously noted (E. S. R., 34, p. 668). When four months old, however, the control stopped growth, while the pituitary-fed cock continued its rapid development and in three weeks had become much

larger and heavier than the control. A difference of time in beginning to crow and marked differences in the general appearance of the pituitary-fed chick were also observed.

The use of energy values in the computation of rations for farm animals, H. P. Armsby (*U. S. Dept. Agr. Bul. 459 (1916), pp. 29*).—This is a revision of Farmers' Bulletin 346 (E. S. R., 20, p. 968). In the computation of rations for farm animals in this bulletin feeding stuffs are compared on the basis of total dry matter, digestible protein, and net energy value.

Energy values of red-clover hay and maize meal, H. P. Armsby, J. A. Fries, and W. W. Braman (*U. S. Dept. Agr., Jour. Agr. Research, 7 (1916), No. 9, pp. 379–387*).—This is a report of experiments conducted at the Pennsylvania Institute of Animal Nutrition, in cooperation with the Bureau of Animal Industry of this Department, upon the net energy values of red-clover hay and corn meal, made for the purpose of clearing up discordant results obtained from these two feeding stuffs in investigations previously reported (E. S. R., 33, p. 72).

In these experiments five feeding periods of 21 days each were conducted with a 2-year-old Shorthorn steer weighing about 500 kg. at the beginning of the experiments. In two of the periods clover hay alone was fed in amounts to constitute respectively a submaintenance and a heavy ration, and in the other three peroids clover hay and maize meal 1:2 in amounts much below maintenance, approximately maintenance, and a heavy ration, respectively. These experiments were conducted along the line of those previously referred to.

It was found that the metabolizable energy per kilogram of the digested organic matter was 3.52 therms for the clover hay and 3.76 therms for the maize meal, as compared with 3.49 therms and 3.8 therms, respectively, as previously reported. The average increment in heat production caused by the consumption of 1 kg. of dry matter was for clover hay 954 and for maize meal 1,143 calories. When these results are combined with those of previous experiments, the corrected values for the average heat increment per kilogram dry matter are for clover hay 973 and for maize meal 1,289 calories. The average net energy values per kilogram of dry matter obtained by the use of the foregoing averages were for clover hay 981 and for maize meal 1,913 calories.

Studies of the composition and digestibility of several of the more important meadow grasses, F. Honcamp, B. Stau, and H. Müllner (*Landw. Vers. Stat., 87 (1915), No. 4–5, pp. 315–350*).—The chemical composition and the digestion coefficients, as determined in a series of digestion experiments with sheep, are given for the following species: *Lolium perenne*, *L. italicum*, *Dactylis glomerata*, *Phleum pratense*, *Poa pratensis*, *P. trivialis*, *Festuca pratensis*, and *F. rubra*. A chemical study of these and other grasses grown on upland moor, lowland moor, mineral, and starch soils indicated a much higher feeding value for the grass grown on the moor soils. The authors state that, in general, there is little difference in the feeding value of the species studied when grown under comparable conditions.

[Animal husbandry work in Alaska], C. C. Georgeson and M. D. Snodgrass (*Alaska Stas. Rpt. 1915, pp. 22–24, 26, 79–81*).—The greater portion of the Kodiak Station herd of Galloway cattle was wintered at Kalsin Bay on native hay and silage and oat silage put up the previous year. Three cows with their calves and the herd bull were wintered at Kodiak on native hay and oat silage. Two cows died late in the winter from inflammation of the liver, due perhaps to moldy silage. In the dairy work nine cows were milked and records kept of their performance. The milk was tested for fat and the whole milk was fed to the calves. A few of the cows did fairly well for a beef breed. By

persistent effort the characteristic shyness and nervousness of the Galloway calves and heifers are being overcome.

The station flock of 14 ewes, 4 wethers, and 1 ram was wintered at Kalsin Bay. They were kept in corral and open shed after December 2. Fourteen lambs were dropped during the latter part of April and May, of which 7 ewe lambs and 4 ram lambs were saved. In order to prevent further depredations by the brown bear the flock was placed on an island near Kodiak for summer pasture. The lambs grew rapidly during the summer months and the ewes kept in prime condition. The clip was of good staple and fairly clean, averaging 7 lbs. per head.

Suggestions are given for future work in the breeding of cattle and horses for the needs of Alaska.

A list of breeders of pure-bred live stock in Montana (*Montana Sta. Spec. Circ. 3 (1916), pp. 23*).—This gives a list of breeders of pure-bred horses and jacks, cattle, swine, sheep, and goats in the State.

The utilization of feed by range steers of different ages.—II, Alfalfa hay and milo maize meal, F. W. CHRISTENSEN, H. H. SIMPSON, and L. FOSTER (*New Mexico Sta. Bul. 103 (1916), pp. 117, figs. 11*).—In the experiment here reported, the plan and details of which were the same as those previously noted (E. S. R., 32, p. 467), five steers each of calves, yearlings, 2-year-olds, and 3-year-olds were fed like rations under similar conditions for 120-day periods. The calves and yearlings were used in the 1913 test and the others in the 1915 test. The animals used in 1913 were mostly high-grade Hereford range steers and those in 1915 were largely grade Shorthorns, the 3-year-olds lacking considerably in uniformity of type and condition. The feeds used were first-cutting alfalfa hay and milo maize meal of good quality. Analyses are given of the feeds used each year, and from the proportions of the feed constituents in the residues the amounts of hay and grain consumed were calculated on the basis of crude fiber content.

The average daily gains per head made by the calves, yearlings, 2-year-olds, and 3-year-olds, omitting abnormal and doubtful results, were 1.55, 1.89, 2.12, and 1.57 lbs., respectively, and per 1,000 lbs. of live weight 2.7, 2.21, 2.25, and 1.52 lbs., respectively. The amounts of feed consumed per steer daily were 10.74, 17.77, 19.95, and 19.49 lbs., respectively, and per pound of gain 6.96, 9.57, 9.63, and 12.6 lbs., respectively. Diagrams showing by curves the gains made by each steer are given.

Three sets of digestion trials were also made with the calves and yearlings and two sets with the 2-year-olds and 3-year-olds. In these experiments, which lasted 10 days each, two steers were used from each group. The results, which are tabulated in detail, do not show any appreciable or certain superiority of one age of animals over another as regards digestive powers, nor do they show that any particular animal digested his ration better than others. No direct relation was found between the amounts of feed consumed and the digestive coefficients. However, the rations fed were not heavy. The average percentages of digestibility of the alfalfa hay and milo maize meal ration are given, and the composition of each feed and other data in connection with these digestion trials are tabulated.

A method is given for calculating the digestibility of the components of a ration composed of two or more feeds from the coefficients of digestibility of the feeds when fed in combination, but in different proportions, in two or more trials and when no separate determinations of digestibility of any of the components of the ration have been made. The calculated percentages of digestibility of the alfalfa hay in the 1913 experiment were as follows: Dry matter, 63.71; organic matter, 64.16; protein, 61.28; nonprotein, 100; crude fiber, 41.28;

ether extract, 31.66; nitrogen-free extract, 77.02, and total nitrogen, 68.13. The corresponding percentages for the other experiments were as follows: Alfalfa hay in 1915, 53.81, 55.77, 50.77, 100, 37.96, 40.1, 73.21, and 60.84; milo maize meal in 1913, 74.29, 76.06, 46.46, 100, 67.7, 63.18, 82.03, and 49.43; and milo maize meal in 1915, 76.88, 76.9, 61.83, 100, 30.9, 72.84, 80.33, and 61.42, respectively. Owing to the wide variations obtained the coefficients for the ash were not calculated.

Nitrogen balances secured in connection with the digestion trials show considerable irregularities with the same individuals in successive trials and between the groups of different ages, but it is evident that the calves were gaining in protein at a much more rapid rate than the other steers. In spite of irregularities in the results, the data also suggest that the yearlings gained in protein somewhat faster than the older steers. The estimated amount of energy stored per unit of gain by the 3-year-olds was 2.5 times and by the yearlings and 2-year-olds about twice that of the calves.

The average percentages of dressed beef obtained in the slaughter tests of these steers were as follows: Calves, 57.08; yearlings, 59.24; 2-year-olds, 58.72, and 3-year-olds, 57.59. No distinctive differences were apparent in reference to the wholesale cuts from the various steers. The results of chemical analyses of the cuts of meat from the different groups of steers also showed no decided differences among them. The fat content of the round and shoulder cuts was about the same for the different ages of steers. In quality of meat the yearlings surpassed the calves chiefly on account of the larger amount and better distribution of the fat through the lean and in the firmness of the meat. The meat of the calves and yearlings appeared a little finer in grain and was more tender than that of the 2- and 3-year-olds. All the meat was of good quality.

Some experiments and practical demonstrations in hog feeding at the Delta Branch Experiment Station, G. B. Walker (*Mississippi Sta. Bul. 177* (*1916*), *pp. 16, figs.* 7).—In a 90-day test in 1914 3 pigs on alfalfa pasture made an average daily gain of 0.59 lb. per head as compared with an average gain of 1.26 lbs. for 3 pigs on alfalfa pasture supplemented by all the shelled corn they would eat once a day. Valuing the gains at 7 cts. per pound alfalfa pasture in this test was worth $3.71 per head for the 90 days' grazing. In this test corn was worth $1.23 per bushel as a supplement to alfalfa pasture.

Varying results were secured in 1914 and 1915 in tests of the value of copperas for preventing cotton-seed meal injury to hogs and of the effect of copperas on gains. In the 1914 test 6 3-months-old pigs were fed for 90 days, 3 of the pigs receiving about 3 lbs. shelled corn and 1 lb. cotton-seed meal per head daily, both feeds being fed dry, and the other 3 pigs receiving similar amounts of corn and cotton-seed meal and in addition 1 gal. copperas solution (1 lb. copperas to 50 gal. water) to each pound of cotton-seed meal. All the pigs were kept in dry lots and had access to shade, water, and salt. The lot fed copperas gained 0.33 lb. and the other lot 0.4 lb. per head daily. All the pigs went through the test in good shape, none showing any evidence of injury from cotton-seed meal.

In the first test in 1915, which was similar to the above, one of the 3 pigs fed corn and cotton-seed meal alone was found dead on the forty-third day of the test, another was found dead on the eighty-first day, while the third went through the 90 days apparently in good shape, making an average daily gain of 0.7 lb. The 3 pigs fed copperas lived through the 90 days and made an average gain of 0.71 lb. per head daily.

In the second test in 1915 the pigs were fed the same as in the above except that the self-feeder was used for the lot fed corn and cotton-seed meal. One of the pigs in the self-feeder lot was found dead on the forty-third day. The other

2 went through the 90 days in good shape, averaging 1 lb. per head daily. The 3 pigs fed copperas went through the test in good condition and made an average daily gain of 1.03 lbs. per head. The third test in 1915 was on the same plan as the second except that both lots were allowed to graze on alfalfa at night. All the pigs went through the 90-day test in fairly good shape, those fed copperas making a daily gain of 1.16 lbs. and the others 1.3 lbs. per head.

Three experiments were conducted in 1915 in which self-feeding was compared with hand feeding. In the first of these, with 8-months-old pigs, 3 pigs fed corn and tankage, balanced according to a feeding standard, gained 1.51 lbs. per head daily for 90 days at a cost of 7.45 cts. per pound of gain as compared with 1.58 lbs. at a cost of 5.71 cts. for 3 pigs fed corn and tankage unmixed in a self-feeder. In a similar test with younger pigs for 75 days the hand-fed lot gained 1.54 lbs. per head daily at a cost of 5 cts. per pound of gain, and the self-feeder lot 1.81 lbs. at a cost of 3.73 cts. The third test of this series was similar to the other two except that cotton-seed meal was substituted for tankage and the duration was 60 days. The hand-fed lot gained 1.76 lbs. per head daily at a cost of 4.82 cts. per pound of gain and the self-feeder lot 1.85 lbs. at a cost of 4 cts. In these tests the pigs were kept in dry lots and had access to shade, water, salt, and charcoal.

In an experiment to determine the benefit of either tankage or cotton-seed meal as a supplement to corn and alfalfa pasture 9 pigs averaging 52 lbs. each were fed for 90 days in 3 lots of 3 pigs each. In this test the grain rations were fed in self-feeders. The lot fed corn gained 1.31 lbs. per head daily at a cost of 3.39 cts. per pound of gain, those fed corn and tankage gained 1.35 lbs. at a cost of 3.42 cts., and those fed corn and cotton-seed meal gained 1.25 lbs. at a cost of 3.54 cts.

In a test of black-strap molasses as a substitute for corn 3 pigs fed corn and cotton-seed meal (5:1) gained 1.76 lbs. each daily for 60 days at a cost of 4.82 cts. per pound of gain. During the same period 3 pigs fed molasses and cotton-seed meal (1:1) gained 1.2 lbs. daily per head at a cost of 7.1 cts. per pound of gain. In this test each of the lots received the same amount of cotton-seed meal.

In another test 4 65-day-old pigs from the same litter were fed for 90 days to compare corn alone on dry lot with corn and alfalfa pasture. The pigs in each of the lots had all the corn they would eat, and those in one lot had access to alfalfa pasture at night. The 2 pigs on corn alone gained 0.33 lb. and those on corn and alfalfa pasture 1.22 lbs. per head daily. In this test the pigs on corn alone returned a profit of 75 cts. each and those on corn and alfalfa pasture $5.69 each, valuing the alfalfa pasture at $1.

In estimating the cost of gains in the above tests corn was valued at 70 cts. per bushel, tankage $50 per ton, cotton-seed meal $25 per ton, and molasses 15 cts. per gallon.

Suggestions are given for the breeding and care of hogs under southern Mississippi conditions.

Feeding experiment with a mixed feed, O. VON CZADEK (*Ztschr. Landw. Versuchsw. Österr., 19 (1916), No. 2, pp. 62–70*).—Analytical data obtained in a feeding experiment with pigs in which a mixed concentrate of meat and blood meals, cereals, and legumes was used in connection with a basal ration are submitted in detailed tabular form.

It is concluded in general that the claim that the concentrate used has a specific nutritional action and a stimulating effect on the digestion of the remainder of the ration is not substantiated by the results of the experiment.

Distribution of public-service stallions in Wisconsin in 1916, A. S. ALEXANDER (*Wisconsin Sta. Bul. 273 (1916), pp. 64, figs. 3*).—It is estimated that

there were 712,000 horses in Wisconsin January 1, 1916, with an average value of $124 each. There was an increase of 7,000 horses in the State during 1915. The percentage of pure-bred stallions continues to increase slightly notwithstanding the fact that few sires were imported during the year.

A directory is given of the owners of public-service stallions and jacks of the State.

Concerning poultry feed values, G. R. and MRS. SHOUP (*Washington Sta., West. Wash. Sta., Mo. Bul., 4 (1916), No. 9, pp. 13–16*).—The authors submit tabular data of tests carried on at the substation showing the palatability and digestibility of 27 feeds used for poultry, together with compiled cost and nutritive value data. The data are also briefly discussed.

Dwarf eggs of the domestic fowl, R. PEARL and MAYNIE R. CURTIS (*Maine Sta. Bul. 255 (1916), pp. 289–328, figs. 7*).—This bulletin gives in less detail the results of a study reported from another source (E. S. R., 36, p. 73).

A list of breeders of standard-bred poultry in Montana (*Montana Sta. Spec. Circ. 4 (1916), pp. 17*).—In addition to this list notes are given on the poultry industry of the State.

DAIRY FARMING—DAIRYING.

Report of the Sixth International Dairy Congress (*Compt. Rend. 6. Cong. Internat. Lait. Berne, 1914, pp. 334, pls. 6*).—This is the report of the proceedings of the Sixth International Dairy Congress, held at Berne, Switzerland, June 8–10, 1914 (E. S. R., 30, p. 398), including the composition of the permanent bureau and various committees of the congress and of the National Committee of Switzerland, the rules of the congress, a list of official delegates, papers and supplementary communications received by the different sections, reports of proceedings of the different sections, resolutions adopted by the congress, social features, and a list of members present.

Judging dairy cows, G. C. HUMPHREY (*Wisconsin Sta. Bul. 274 (1916), pp. 41, figs. 34*).—This bulletin discusses and shows by means of illustrations the visible characteristics of a good dairy cow, including indications of digestive capacity, temperament and blood circulation, and udder development; and some common deficiencies met with in cows. Other points discussed in the bulletin are the importance of type, constitution, and breeding of dairy cows, production records, value of pedigrees, essentials in becoming an expert judge of live stock, use of score cards, and the organization and holding of judging contests. A scale of points is given of each of the leading dairy breeds of cattle, together with an illustration and record of one of the highest producing representatives of each breed in Wisconsin and the record of the world's champion cow of each dairy breed.

[A new world's champion dairy cow] (*Breeder's Gaz., 70 (1916), No. 8, p. 280*).—The 4-year-old Holstein heifer, Queen Piebe Mercedes, recently completed a year's semiofficial test with a production of 30,230.2 lbs. of milk and 1,111.285 lbs. of milk fat. In no month during the year did she produce less than 2,000 lbs. of milk or less than an equivalent of 100 lbs. of butter. Her average fat test for the whole year was 3.68 per cent.

Reducing the cost of milk production, H. L. BLANCHARD (*Washington Sta., West. Wash. Sta. Mo. Bul., 4 (1917), No. 10, pp. 3–6*).—In this article an attempt is made to outline a system of management and feeding by which an ordinary herd of cows with an average annual production of 5,000 to 6,000 lbs. of milk can be made to pay the owner a profit. Using analyses given in Henry's Feeds and Feeding (E. S. R., 34, p. 261), the author has calculated and tabulated the approximate milk equivalent of feed produced on one acre by various

crops. Among the suggested uses of the data is a method of determining the live stock capacity of a farm, making the dairy cow the unit.

A review of the milk situation in New York, J. J. DILLON (*Hoard's Dairyman, 52 (1916), No. 16, pp. 550, 551*).—The author reviews briefly the conditions surrounding the milk supply of New York City during the last 40 years and gives rather full information regarding the recent agitation between milk producers and dealers supplying the New York market.

Common sense in dairy inspection, E. KELLY (*Cornell Countryman, 14 (1916), No. 2, pp. 109–112, fig. 1*).—In this article the advantage of educational work in the improvement of milk supplies is emphasized.

In the author's opinion the health department that deals only with the production of sanitary milk and not with the economic problems which face the dairymen is shortsighted. "Profit for the producer is absolutely necessary if clean milk is to be produced for the people in the cities, and it is well for us to have this in mind as we go about the work of dairy inspection."

The grading of milk in small communities, L. R. WILLIAMS (*Amer. Jour. Pub. Health, 6 (1916), No. 10, pp. 1093–1099*).—In this paper the author reviews the progress being made in the campaign on the grading of milk in cities having a population of less than 50,000 and in the villages and smaller communities in New York since the adoption of the state milk code.

The new state dairy law, C. L. ROADHOUSE (*Univ. Cal. Jour. Agr., 4 (1916), No. 2, pp. 43, 62, 63, fig. 1*).—The objects and provisions of the new California state dairy law which became effective October 1, 1916, are briefly stated.

This law provides that all milk and cream or other milk products except cheese sold in retail trade must either be produced from animals which have passed an official tuberculin test or the milk must be pasteurized. It also provides for the grading and labeling of milk when it is sold in cities where a dairy inspection department is maintained. The author states that it is not the intention of the authorities to attempt the enforcement of the portion of the law which pertains to cream for butter making since this is not included in the heading of the law.

Directions are given for the tuberculin testing of cattle and the pasteurization, grading, and labeling of milk in conformity with this act.

The heat resistance of nonspore-forming bacteria in milk, C. GORINI (*Clin. Vet. [Milan], 39 (1916), No. 15, pp. 445–450*).—Summing up his studies on the survival of nonspore-forming bacteria in sterilized milk the author states that this phenomenon is due either to the presence of a species or race of microbes possessing exceptional heat-resisting qualities, or to the protective influence of enveloping casein which is formed around the individual germs, probably due to the biochemistry of the germ itself, either before or during sterilization.

The value of efficient, commercial pasteurization in safeguarding milk naturally infected with tubercle bacilli, J. TRAUM and G. H. HART (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 5, pp. 678–698*).—The authors give a brief review of the most important literature on the thermal death points of tubercle bacilli, and report experiments along this line with samples of milk from a herd consisting entirely of cattle which had reacted to the tuberculin test.

The milk from this herd was pasteurized in a large milk plant in the regular routine manner of pasteurizing, all milk going through the plant. The pasteurization was done in a battery of three large insulated water-jacket vats in which the milk was constantly agitated by means of revolving feed worm coil pipes. Samples were taken of the raw milk from the weigh tank, of the

clarified milk, and of the pasteurized milk, and two or three guinea pigs were inoculated with the cream and sediment obtained by centrifuging each sample.

Of the 24 samples of raw milk used all except one produced tuberculosis in the inoculated guinea pigs, and in this case both inoculated guinea pigs died from septicemia. After clarification 14 samples of the same milk produced tuberculosis in all of the inoculated guinea pigs in all but three cases, and in one of these both inoculated guinea pigs died of septicemia. From the other two samples one guinea pig in each case developed tuberculosis while the other died soon after inoculation. After pasteurization 23 samples of the same milk (plus the required amount of milk or cream to standardize the vat) failed to produce tuberculosis or cause death from inoculation in a single instance. Twelve of these samples were heated above 140° F. and held for a longer period than 20 minutes. The remaining 11 were definitely known to be heated to 140° and held for only 20 minutes.

From these findings the authors conclude (1) that pasteurization at 140° for 20 minutes kills tubercle bacilli in naturally infected milk, (2) that with a properly insulated tank in which the heating and holding are done in the same tank, while the milk is being constantly agitated, one can produce and hold the temperature of all the contained milk at the desired point and for the desired length of time, and (3) that clarification of milk naturally infected with tubercle bacilli fails to render it innocuous to guinea pigs.

In these tests it was found that tubercle bacilli were not destroyed in milk samples preserved with 1 per cent boric acid. Such preservation was sufficient to allow samples to be shipped considerable distances without their undergoing undesirable changes which interfere with laboratory examinations and guinea-pig inoculations.

Comparison of the rate of multiplication of bacteria in raw milk with the rate in pasteurized milk, P. W. Allen (*Jour. Infect. Diseases, 19 (1916), No. 5, pp. 721–728, figs. 7*).—In the experiments reported aseptically drawn milk was obtained from cows with a low udder bacterial content and 200-cc. samples were measured out. One portion was pasteurized and the other was not. After pasteurization the treatment of the two portions was the same. Parallel samples in a part of the series were inoculated with *Bacterium lactis acidi* from Ericsson's butter culture in sufficient quantities to mask the effect of the udder organisms. Into each of the samples of the remaining series was inoculated by means of a special pipette one chromogenic bacterium which, on account of the extreme color, could be easily distinguished from the udder organsms. The plate counts of the different samples are tabulated and graphs are given of parallel samples of most of the series.

It was found that raw milk, as compared with pasteurized milk, exerts a powerful suppressing influence on the multiplication of certain bacteria. When *B. lactis acidi* is accustomed to the milk of a certain cow, however, apparently no killing off of this organism takes place in freshly drawn milk. When a single cell of certain pronouncedly chromogenic kinds of bacteria is added to fresh milk, the organism is found plentifully in the milk after 16 hours at 20° C., the injurious action of freshly drawn milk not being sufficiently intense to kill the one bacterial cell. After pasteurization, the organisms which remain in the milk and those which are able to get into it find conditions more favorable for their rapid multiplication than before pasteurization.

The relation of lactic acid bacteria to milk of different degrees of freshness, A. Voitkevich (A. Wojtkiewicz) (*Viestnik Bakt. Agron. Sta. V. K. Ferreïn, No. 22 (1916), pp. 55–79*).—The author takes exception to the conclusions of Paraschtschuk (E. S. R., 31, p. 506) that certain species of lactic-acid bacteria develop more rapidly in fresh milk than in milk which is not fresh.

In the investigations reported *Bacillus bulgaricus*, *Streptococcus hollandicus*, and three varieties of *Bacterium lactis acidi* were used. It was found that the majority of these lactic-acid bacteria develop as readily in milk which is not fresh as in fresh milk. Two of the three strains of *B. lactis acidi* showed the reaction of Paraschtschuk, one feebly and the other, isolated from Hansen's dry lactic ferment, very distinctly. These species of bacteria coagulate and acidify old milk more rapidly than fresh milk. The different degrees of sensibility of the bacterial reaction in milk of the same degree of freshness render the Paraschtschuk method unacceptable.

Further researches with Hansen's bacillus show that the increase of protein cleavage products in milk, due to inoculation with peptonizing saprophytes, the addition of peptone, and the action of rennet, augments the acid-forming ability of this microbe. In view of the fact that the preliminary inoculation of fresh milk with a vigorous strain of *B. lactis acidi* followed by sterilization increases the acidity produced by Hansen's bacillus, it is thought that lactic-acid bacteria in their preliminary phase of development in milk cause proteolysis by secreting the proper ectoenzyms. Preliminary inoculation with *B. bulgaricus* produced no effect, indicating that proteolytic enzyms of different species of lactic-acid bacteria are not of the same order.

Advantages of using milk of low bacterial content in studying the phenomena of lactic fermentation, R. Burri and G. Hohl (*Schweiz. Zentbl. Milchw.*, *5* (*1916*), *Nos. 2, pp. 12–14; 3, pp. 19–23; abs. in Internat. Inst. Agr.* [*Rome*], *Internat. Rev. Sci. and Pract. Agr.*, *7* (*1916*), *No. 4, pp. 596, 597*).—This is a report of the first portion of a series of experiments at the Dairying and Bacteriological Institute of Berne-Liebefeld on the scientific principles underlying the lactic fermentation test. Milk samples with an average bacterial content of from 200 to 300 per cubic centimeter were obtained from four cows by means of aseptic milking. The experiments extended over three different periods, each of several days' duration.

The experiments have confirmed the conclusions of others that about one-tenth of the bacterial content of milk immediately after being drawn is derived from the interior of the udder. The species of bacteria were found to vary in different cows, but were always constant for the same cow. *Bacterium güntheri* liquefactive in the milk of two cows, white liquefying micrococci for the milk of the third cow, and liquefying micrococci and streptococci in the milk of the fourth were the species found.

The fermentation test applied to these samples showed that the liquefying *B. güntheri* is the chief factor exerting an unfavorable influence on the phenomena of lactic fermentation. This organism causes the formation of a curd whose degree of consistency is intermediate between that of casein and that of whey-curd.

These results show that the bacteria of the udder may have injurious effects on the quality of milk and its derivatives.

A common, but incorrect, statement concerning the number of bacteria in milk, R. S. Breed (*Science, n. ser.*, *44* (*1916*), *No. 1143, pp. 749, 750*).—The author advocates the abandonment of the present custom of referring to agar-plate counts as showing the number of bacteria in milk, since these counts show only the number of colonies developing on the nutrient medium under the conditions of incubation used. Studies at the New York Cornell and Geneva experiment stations are cited which tend to show that the actual number of bacteria in milk may be from 2 to 25 times the number of colonies developing on agar plates even after prolonged incubation.

Cheese factory and creamery instruction and inspection (*Agr. Gaz. Canada*, *3* (*1916*), *No. 11, pp. 964–985, figs. 8*).—This is a series of articles in which there

are brought together the policies and methods of the different Provinces of Canada with reference to cheese factory and creamery instruction and inspection.

The chromogenic micro-organisms of cheese and their presence in the Italian "robbiola," G. DALLA TORRE (*Staz. Sper. Agr. Ital., 49 (1916), No. 1, pp. 59–67; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 4, p. 600*).—The author gives a list of the principal chromogenic micro-organisms occurring in cheese, with notes on their action and the results of a bacteriological analysis of a sample of robbiola cheese made for the purpose of determining the micro-organisms causing the spongy interior and yellow outside cover of this cheese.

The sponginess was found to be due to a bacterium of the *B. aerogenes-coli* group. Of the 13,000,000 bacteria per gram of cheese, 200,000 belonged to this group. The remainder were chiefly *B. lactis acidi*. The micro-organism causing the yellow exterior coloration in robbiola cheese was found to be a distinct species with the following characters: Micrococcus, 0.8 to 1 μ in diameter; produces a yellow or yellowish green substance; necessarily aerobic; coagulates milk and dissolves the coagulate, giving an acid reaction; and loses its coloring properties and odor when cultivated several times in succession.

The preparation of homemade rennet, A. TODD and ELFRIDA C. V. CORNISH (*Jour. Bd. Agr. [London], 23 (1916), No. 5, pp. 459–462, fig. 1; Bd. Agr. and Fisheries [London], Leaflet 60 (1916), pp. 4, fig. 1*).—Detailed directions are given for the preparation of rennet from the fourth stomach of calves. It is stated that rennet prepared by the method described has been used in cheese making with apparently satisfactory results.

VETERINARY MEDICINE.

The pathology and differential diagnosis of infectious diseases of animals, V. A. MOORE (*New York: The Macmillan Co., 1916, 4. ed., rev. and enl., pp. XVI+593, pl. 1, figs. 120*).—A revised and enlarged edition of the work previously noted (E. S. R., 21, p. 579). Two appendixes have been added, one on the requirements for interstate shipment of live stock and the other on the Federal regulations for the veterinary inspection of meat.

Special pathology and therapeutics of the diseases of domestic animals, F. HUTYRA and J. MAREK, edited by J. R. MOHLER and A. EICHHORN (*Chicago: Alexander Eger, 1916, 2. ed., vols. 1, pp. XVI+1213, pls. 12, figs. 231; 2, pp. XVII+1108, pls. 7, figs. 207*).—This second English edition of the work previously noted (E. S. R., 28, p. 778), based on the fourth revised and enlarged German edition, contains much information gained since the publication of the third edition. It includes the new features of the fourth German edition, and in many instances the editors have added other data relating especially to conditions prevalent in this country.

The first volume, in addition to new chapters on paratyphus of hogs and on sporotrichosis, also contains many elaborations in most of the chapters, especially with reference to etiology, allergic reactions, serodiagnostic methods, and immunizations. Ascoli's precipitation reaction in anthrax and swine erysipelas and the salvarsan treatment in contagious pneumonia of horses have been given due consideration. The chapter on protozoan diseases has been carefully revised and brought up to date. The authors have felt justified in separating and differentiating the catarrhal form of influenza from the pectoral form or contagious pneumonia of horses.

In the second volume, on organic diseases, new chapters have been prepared on catarrh of the sphenoidal sinus, dysentery, localization of the cerebral affec-

tions, infantile paralysis, guinea pig paralysis, paralysis of the hypoglossal nerve, tetany, necrobacillary ostitis and osteomyelitis, etc. Infectious spinal meningitis of horses (Borna disease) has been revised and separated from the other forms of meningo-encephalomyelitis (meningitis cerebrospinalis enzootica). The chapters on progressive pernicious anemia, leukemia of mammals, pseudoleukemia, blood filaria, nephritis, catarrh of the guttural pouches, pharyngitis, traumatic gastritis, intestinal hemorrhage, gastro-enteritis, cerebral diseases, affections of the peripheral nerves, neuroses, serum disease, pemphigus, and parasitic affections of the organs have been either entirely revised or markedly changed. A uniform arrangement has been followed in practically every fever chart, and references to recent literature have been included.

Text-book of special pathology and therapy of domestic animals, E. FRÖHNER and W. ZWICK (*Lehrbuch der speziellen Pathologie und Therapie der Haustiere. Stuttgart: Ferdinand Enke, 1915, 8. rev. ed., vol. 1, pp. XVI+929, figs. 89*).—This is the eighth revised edition of the work previously noted (E. S. R., 12, p. 596). This volume deals with the diseases of the digestive organs, liver, abdomen, kidneys, reproductive organs, heart and blood vessels, skin, organs of locomotion, nervous system, and organs of respiration, and chronic constitutional diseases. A classified bibliography of the literature relating to these diseases is appended (pp. 829–916).

The origin and development of the lymphatic system, FLORENCE R. SABIN (*Johns Hopkins Hosp. Rpts., 17 (1916), pp. 347–440, figs. 19*).—As is pointed out by the author the fundamental morphology of the lymphatic system has been established, but there remain many gaps in our knowledge of the system as a whole.

Relationship between serum reactions, H. WEHRBEIN (*Jour. Infect. Diseases, 19 (1916), No. 6, pp. 806–810*).—From a study of the relation of the numerical values of the titers of serum reactions the author found that there was no coincidence between the titers of hemagglutinins and hemolysins, either against the same antigen or againsst different antigens. Using *Bacillus coli*, *B. subtilis*, and *B. pyocyaneus*, no relation between the agglutinin titers was observed. A rather even production of seroprecipitins, however, was obtained in three tests of five rabbits each, horse, pig, and sheep serum being used as antigen.

Relation of specific precipitation to other immunity reactions, H. A. BULGER (*Jour. Infect. Diseases, 19 (1916), No. 6, pp. 832–839*).—Experiments are reported from which it is concluded that "in small amounts the precipitate formed by action of immune serum and antigen, and also sensitized organisms, will remove antiferments from sera. This may show the relation of precipitins to anaphylactic and Abderhalden reactions. The absorbing action of sensitized organisms and precipitate is not specific. They will remove the antiferment not only from the homologous sera but also from heterologous sera. There is a quantitative relation between the amounts of precipitate and sensitized organisms and the maximal amount of absorption of the antiferment."

Hypodermal anaphylaxis, F. TORRANCE (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 3, pp. 309–311, figs. 2*).—Experiments by S. Hadwen, of the Health of Animals Branch of the Department of Agriculture, Canada, are noted in which cattle were inoculated with an extract of *Hypoderma bovis*. Shortly after the inoculation the animals began to salivate, tears ran from the eyes, gaseous feces and clear mucus were passed, there was rapid breathing, labored heart action, and a purplish coloration of the skin. Very soon the lids became swollen and the anus became edematous.

An animal injected with an extract of eight *H. lineatum* larvæ developed the symptoms before the inoculation was completed and died within five minutes.

It is indicated that cattle harboring warble larvæ become sensitized to them, and that when the system becomes suddenly flooded with the protein of the larvæ (and possibly toxins) anaphylactic shock results.

The effect of toluene on the production of antibodies, L. HEKTOEN (*Jour. Infect. Diseases, 19 (1916), No. 6, pp. 737–745*).—Similar experiments to those made with benzene, previously noted (E. S. R., 35, p. 781), were made with toluene, and the results reported.

In repeated doses of about 1 cc. per kilogram of body weight the toluene diminished the output of antibody in the earlier periods of antibody production, and under certain conditions caused long persistence of antibody in the blood, with marked fluctuations in the concentration in some of the cases. The same increased persistence of antibody in the blood may result from the injection of smaller doses of toluene.

No immediate change as to number and proportion of leucocytes in the blood of rabbits nor any change in the phagocytic activity of the leucocytes in vitro was observed.

"In rabbits receiving the larger doses of toluene there occurs a transitory myeloid hyperplasia in the bone marrow, but later no marked changes in the marrow or other organs appear. On this account there is at present no basis for concluding whether the fluctuation and persistence of antibodies in the blood is better explained as resulting from increased and prolonged production of antibodies, or as resulting from interferences with the passage of antibodies out of the blood."

Comparative action of antiseptics on pus and on pure cultures, A. LUMIÈRE (*Compt. Rend. Acad. Sci. [Paris], 163 (1916), No. 13, pp. 309–311*).—Data are submitted which show the marked effect of the albuminous material of pus in decreasing the bactericidal action of phenol, hermophenyl (mercuric phenol disodium sulphonate), and sodium hypochlorite.

For the treatment of suppurating wounds the free use of relatively concentrated hypochlorite solutions is recommended. It is indicated that the hypochlorite oxidizes the toxins of the pus and plays an important part in the defense of the organism against intoxication and the spread of infection.

The significance of certain natural flagellates of insects in the evolution of disease in vertebrates, H. B. FANTHAM and ANNIE PORTER (*Jour. Parasitology, 2 (1916), No. 4, pp. 149–166, figs. 2*).—A further report of work (E. S. R., 35, p. 782).

Observations on the blood in East Coast fever of cattle, C. STRICKLAND (*Parasitology, 8 (1916), No. 3, pp. 244–248*).—"There is very little, if any, abnormal destruction of erythrocytes in cases of infection with East Coast fever. This is proved by blood counts, hemoglobin estimations, and the condition of the blood-forming and blood-destroying organs, all remaining practically normal. This is in marked contrast to what obtains in piroplasmosis.

"The hypothesis advanced by Nuttall fits all the facts. According to this hypothesis the invasion of the corpuscles occurs in the internal organs where the parasites develop, and the corpuscles only act as carriers of the parasites in the blood, thereby conveying them to the tick which serves as the vector. Since few, if any, of the corpuscles are destroyed they rapidly become charged with an increasing number of parasites, which are being continuously produced in the internal organs as evidenced by Koch's blue bodies which form and break up in the lymphatic glands, spleen, liver, bone marrow, etc. (Gonder, Nuttall).

"There is a marked leucopenia in East Coast fever, the polymorphs decreasing less rapidly than the other elements. This is in contrast with the leucocytosis observable in piroplasmosis."

The significance of the mallein ophthalmic test as a diagnostic aid in the control of glanders, J. Bongert (*Monatsh. Prakt. Tierheilk.*, *27* (*1916*), *No. 5–6, pp. 177–233, figs. 2*).—From the results of a thorough study the author concludes that the ophthalmic mallein test is as trustworthy as the serological test and is much simpler and easier to manipulate, especially in the diagnosis of a large number of animals. For the practical diagnosis of glanders the combined ophthalmic and serological test is recommended. This procedure is deemed the safest and most rapid to use in order to prevent the unnecessary killing of healthy animals.

The importance of repeated biological tests in the control of a glanders epizootic is emphasized. In a first examination of an animal the combined test indicated above should always be used. In view of the fact that in a recurrence of the disease both the ophthalmic and serological tests may yield negative results, a thorough clinical examination at no time should be neglected. Without such examination it is deemed impossible to control or eradicate an epizootic.

The presence of tetanus bacilli on the surface of parts of projectiles left in healed wounds, A. Lumière (*Compt. Rend. Acad. Sci.* [*Paris*], *163* (*1916*), *No. 15, pp. 378–380*).—A number of cases are reported in which symptoms of tetanus developed after the healing of the wound. It is considered that the pieces of projectiles left in the healed wounds carried spores of tetanus bacilli which developed and caused a reinfection. It is indicated that in such cases proper precautions should be taken and the extraneous material removed if possible. Antitetanic serum should also be reinjected at the time of the second operation.

A contribution to the value of the avian tuberculin test of Van Es and Schalk, H. Schornagel (*Ztschr. Infektionskrank. u. Hyg. Haustiere*, *17* (*1915*), *No. 3–4, pp. 170–176, fig. 1*).—Experimental data obtained by the use of the intracutaneous tuberculin test of Van Es and Schalk (E. S. R., 31, p. 582) are submitted. The author concludes that the procedure is a valuable diagnostic aid in the detection of avian tuberculosis, and that its manipulation is both simple and rapid.

The economic importance of detecting and eradicating the disease in a flock is emphasized.

The intracutaneous tuberculin test of Van Es and Schalk as a diagnostic aid in avian tuberculosis, H. Jakob and L. Gazenbeek (*Ztschr. Infektionskrank. u. Hyg. Haustiere*, *17* (*1915*), *No. 3–4, pp. 177–191, figs. 6*).—The authors tested 24 birds by the method of Van Es and Schalk (E. S. R., 31, p. 582), of which 16 were tubercular. The remaining fowls were nontubercular and gave negative reactions. Of the 16 cases 8 yielded positive, 2 doubtful, and 6 negative reactions.

The use of the method is deemed to be an important step in the early diagnosis of the disease. A bibliography of 21 references to the literature cited is appended.

A study of the milk in bovine infectious abortion, W. Giltner, L. H. Cooledge, and I. F. Huddleson (*Jour. Amer. Vet. Med. Assoc.*, *50* (*1916*), *No. 2, pp. 157–167*).—Experiments carried out to determine whether *Bacillus abortus* antibodies could be made to appear in the sera of adults by ingestion of infected milk are reported.

Of the seven adults drinking such milk five developed a slight increase in the antibody content of the blood, but in no case was there a marked increase. In only one case did the reaction persist after four weeks from the last drinking of the infected milk. Another experiment, conducted to throw some light on the pathogenic or antigenic properties of *B. abortus* in milk on humans, showed that there was no appreciable increase of the antibody content in the

blood of the individuals and no untoward effects observable. In this experiment negative milk to which 10 cc. of a 48-hour culture of *B. abortus* was added was consumed in quantities of 1 pint per day for a period of six weeks. "There seems to be little evidence to warrant a statement that *B. abortus* in milk is either pathogenic or antigenic to any marked degree for the human adult at least."

Further experiments were conducted in which guinea pigs were fed on naturally infected milk and the results were again negative. "We feel, therefore, that there is not sufficient evidence to condemn positive milk as dangerous to guinea pigs by ingestion, since it has shown no pathogenic action and only slight antigenic action."

Pregnant and nonpregnant rabbits were fed with naturally infected milk for a period of 124 days, the serological results being negative, and no lesions being found in the animals on autopsy. In another series six animals were fed noninfected milk plus a culture of *B. abortus* daily. Two litters of young were born to each rabbit during the experiment, but no abortions occurred in any of the animals, nor were any lesions found on autopsy. It is concluded that positive milk is not dangerous to rabbits by ingestion, since no pathogenic action and only a very slight antigenic action results therefrom.

Calves were fed with naturally infected and noninfected milk at the rate of 1 gal. of milk twice daily to each calf for a period varying from five to 14 weeks. From the results obtained it is concluded that "there is no connection whatever between the feeding of infected or noninfected milk and the matting and staining of the sexual hairs of newborn calves. That *B. abortus* antibodies develop in calves as a result of ingesting naturally infected milk seems to us to be a demonstrated fact, but the cause and significance of the appearance of the antibodies can not be explained until further development of the studies on the calves. The antibodies may be due to an active infection, they may be due to an active immunity, or they may be due to a passive transmission of the antibodies present in the milk. The possibility of infections being acquired in utero seems to us to be a phase of the abortion question that should be given as much attention as other possible modes of infection. Since we have found that 16 per cent of the 12 calves used in this experiment possessed *B. abortus* antibodies at the time of birth, and that the antibodies persisted for many weeks after birth, we conclude that the control of the disease must begin with a study of the calf at the time of birth." The experiments are described in detail.

A further experiment is reported which shows that milk containing *B. abortus* antibodies is highly bactericidal toward the organism. "Therefore milk containing *B. abortus* antibodies that has been heated at a sufficient temperature to kill the organisms and not the antibodies should be looked upon as being beneficial to newborn calves. The milk containing antibodies should give the calf a passive immunity during its early development."

The significance and duration of immunity in bovine contagious abortion, A. Ascoli (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 17 (1915), No. 3–4, pp. 156–169*).—The results of experiments in which guinea pigs were inoculated with *Bacillus abortus* which had been killed with ether, followed by the inoculation of living cultures, are reported. After various periods of time the animals were killed and the spleen examined bacteriologically for the microorganism.

The results showed that immunization in guinea pigs with killed microorganisms does not bring about an increase in resistance to the virus. The animals so inoculated appeared to be even more susceptible to infection than

normal animals. The use of larger doses of the killed organisms caused no difference as to the susceptibility.

Experiments with rats are also described and discussed.

The seasonal prevalence of Hypoderma bovis in 1915, together with observations on the terrifying effect H. bovis has upon cattle and lesions produced by the larva, S. HADWEN (*Ann. Rpt. Ent. Soc. Ontario, 46* (*1915*), *pp. 108–119, figs. 4*).—"The seasonal activity of *H. bovis* at Agassiz is from the beginning of June to the beginning of August. The last larvæ to emerge from the backs of cattle leave during the first days of July. In *H. bovis* the pupal period averages 35 days. High temperatures shorten the pupal period. The fear cattle have for *H. bovis* is due to the insect's persistence and manner of egg laying. Hewitt's observations on the penetration of the skin by the larvæ of *H. bovis* are confirmed. The lesions caused by the larvæ differ from those of *H. lineatum.* Older animals show more lesions than the young."

Castration of young pigs, F. G. ASHBROOK (*U. S. Dept. Agr., Farmers' Bul. 780* (*1916*), *pp. 6, figs. 6*).—A descriptive account prepared for the farmer.

Hog cholera (*North Dakota Sta. Rpt. 1916, pp. 13–15*).—Immunization experiments with a virus from normally susceptible pigs infected by exposure or injection, from serum-infected pigs which sickened in the course of a serum test, from pigs injected with blood from a hyperimmune hog immediately after hyperimmunization, and from hogs which escaped infection after injection with blood from a hyperimmune hog but became infected by injection of virus from normally susceptible pigs infected by exposure or injection are noted. The results indicate that "at least the antigenic properties of a virus may be seriously affected by the protective factors with which it may come in contact during passage."

Experiments to determine the relative resistance of antibodies in antihog-cholera serum to various adverse influences showed that serum kept in a refrigerator for a period of six years retained its full potency at the end of the period. Serum kept at room temperature (70° F.) for a period of 212 days protected an 89-lb. pig by a dose of 35.6 cc., and a 74-lb. pig by a dose of 14.8 cc. "Serum kept at a body temperature for a period of 212 days protected a 74-lb. pig by a dose of 29.6 cc., but failed to protect a 71-lb. pig by a dose of 14.22 cc." Serum kept in a practically permanent frozen condition for over three months was still able to protect pigs.

It is indicated, however, that these results do not render the usual precautions observed in storing and keeping serum unnecessary.

Meeting of committee appointed to recommend best methods of vaccination, control, and eradication of hog cholera (*Indiana Sta. Circ. 56* (*1916*), *pp. 20*).—This circular reports in detail the proceedings at a meeting held March 10, 1916, of a committee appointed at the Fourth Annual Hog Cholera Conference.

The committee, in resolutions adopted, recommended "a more extensive educational campaign among veterinarians and stockmen along sanitation and vaccination lines; the reporting of outbreaks of hog cholera and all herds that are vaccinated to the state veterinarian; the placarding of premises infected with hog cholera; the licensing of persons using hog-cholera blood for vaccinating hogs; . . . the use of hog-cholera blood in doses not less than 1 cc. for the simultaneous vaccination of hogs, and antihog-cholera serum in not less than 20 cc. doses for small pigs, and 30 cc. for pigs weighing 100 lbs., or preferably 40 cc. when used simultaneously; and . . . that the state veterinarian be given the necessary control over the distribution of hog-cholera virus and serum, enabling him to condemn and confiscate any antihog-cholera serum or hog-cholera blood that is impotent, contaminated, or dangerous, in order that he may better

protect the interests of stockmen against losses following vaccination." The indiscriminate use of the simultaneous method of vaccination in nonexposed herds was pointed out as a source of danger, and was not recommended.

Bacillus abortus as an etiological factor in infectious abortion in swine, E. S. Good and W. V. Smith (*Jour. Bact., 1 (1916), No. 4, pp. 415–422*).—The authors at the Kentucky Experiment Station isolated *B. abortus* from the afterbirth of an aborting sow and from the contents of the umbilicus, heart, liver, and stomach of two aborted fetuses. The strain isolated from the sow responded to all the biological and physiological tests of the strains isolated from the uterine exudates of aborting cows, except that the original culture grew in the air after the first generation.

The intravenous inoculation of a pregnant sow with 2 cc. of an agar slant culture in normal saline of the bacillus secured from the aborting sow caused an abortion in 17 days. Feeding the organism to another pregnant sow produced an abortion in 19 days. The organism was again isolated from the aborted fetuses. "The blood serum of each of these sows, after aborting, completely agglutinated a strain of *B. abortus* derived from an aborting cow, in a dilution of 1:100. The complement was fixed in each case with 0.02 cc. of the serum. The serum of a normal hog did not agglutinate in any dilution, nor did it fix the complement."

Equine spirillosis in Morocco, Velu (*Rec. Méd. Vét., 92 (1916), No. 7, pp. 215–224, figs. 2*).—The author reports the occurrence of an equine spirillosis in Morocco which may be confounded clinically with cases of trypanosomiasis. The affection is benign and experimental diagnosis is easy, since the causal agent is inoculable into the dog, rabbit, and white rat.

Leukemia of the fowl: Spontaneous and experimental, H. C. Schmeisser (*Johns Hopkins Hosp. Rpts., 17 (1916), pp. 551–586, pls. 4*).—"The spontaneous occurrence of myeloid leukemia of the fowl is confirmed. Myeloid leukemia in the fowl is transmissible by the intravenous or intraperitoneal injection of an organic emulsion."

The rôle of the flagellated protozoa in infective processes of the intestines and liver, P. B. Hadley (*Rhode Island Sta. Bul. 166 (1916), pp. 3–40, pls. 3*).—In this contribution the author presents evidence of the pathogenic rôle of the flagellated protozoan, Trichomonas, in an almost invariably fatal cecal and hepatic infection in birds. In the first part he deals with the infecting organism and in the second with the parasites in the tissues.

The Trichomonas studied is found in the intestines of all poultry, as well as of most other animals. In the intestines the flagellates are present in the cecal contents, but are found mainly in the mucus layer overlying the epithelium, and often deep in the crypts of Lieberkühn. Reproduction is by simple fission, taking place mainly in the cecal content; also by encystation and spore formation, probably the common method of reproduction in the tissues. Ameboid forms are also encountered, especially in the tissues.

"The gross pathological picture includes congestion and enlargement of portions of the whole or part of one or both ceca, together with the presence of large, circular, yellowish, discrete or confluent, necrotic areas on the liver. These foci extend deep into the tissues. Frequently the ceca may contain a solid, cheesy or leathery, yellow or blood-stained core, composed of coagulated serum, fibrin, and cellular elements. The lumina are frequently quite obliterated. Fusions between the ceca and loops of the intestine, liver, or gizzard may sometimes occur; also between the liver and proventriculus.

"The microscopical pathological features involve the penetration of the epithelial wall by the parasites and a progressive infection of the subepithelial

tissues, where the mode of reproduction is by encystation and spore formation. The result of rapid reproduction is great thickening of the cecal wall. In favorable specimens many of the features of flagellate morphology can be observed in the parasites located in these regions. The liver presents a corresponding appearance of the infecting elements, though more modified by their location.

"Very rarely the pathological condition may be complicated in the liver by an amebic infection (not *Amœba meleagridis*) and in the ceca by both amebas and coccidia (*Eimeria avium*). The picture may also be complicated by infections with Hemoproteus.

"The nature of the infective process, together with extensive clinical experience, makes it clear that intestinal flagellatosis can not be regarded as an infectious disease, and that Trichomonas as found in these infections can not be looked upon as a pure parasite. A successful infection depends upon factors present in the host, and is probably quite unrelated to 'virulence' on the part of the infecting organism. In this sense the infection, commonly called 'blackhead' of turkeys, can not be regarded as an infectious or communicable disease.

"The parasitic flagellates here described are identical with some of the bodies earlier regarded by the writer as stages in the development of the coccidium, Eimeria. They are also identical with bodies described by Theobald Smith under the name *A. meleagridis*, of whose existence, as an ameba, up to the present time no conclusive evidence has been brought forward."

RURAL ENGINEERING.

The people's interest in water-power resources, G. O. Smith (*U. S. Geol. Survey, Water-Supply Paper 400–A (1916), pp. 8*).—This is an address delivered before the Second Pan-American Scientific Congress at Washington, December 28, 1915.

Accuracy of stream-flow data, N. C. Grover and J. C. Hoyt (*U. S. Geol. Survey, Water-Supply Paper 400–D (1916), pp. 53–59*).—It is pointed out in this report that "notes on accuracy that accompany stream-flow records should give, first, information by which the technical man may study the records and judge their accuracy, and second, information by which both the general and the technical user may judge the reliability of the records without making a study." The conditions affecting the accuracy of records of daily discharge are discussed as "permanence of the stage-discharge relation, precision with which the discharge rating curve is defined, refinement of gage readings, frequency of gage readings, [and] methods of applying the daily gage heights to the rating table to obtain the daily discharge."

The measurement of silt-laden streams, R. C. Pierce (*U. S. Geol. Survey, Water-Supply Paper 400–C (1916), pp. 39–51, figs. 2*).—An account of the special difficulties encountered and the results obtained in measuring the flow of the San Juan River are given.

Surface water supply of the Pacific slope basins in California, 1913 (*U. S. Geol. Survey, Water-Supply Paper 361 (1916), pp. 514, pls. 2, fig. 1*).—This report, prepared in cooperation with the State of California, presents the results of measurements of flow made on streams in the Pacific slope drainage basins in California during 1913.

Surface waters of Massachusetts, C. H. Pierce and H. J. Dean (*U. S. Geol. Survey, Water-Supply Paper 415 (1916), pp. 433, pls. 12, figs. 6*).—This report describes the general features and gives the results of measurements of flow made on streams in the Housatonic, Connecticut, Taunton, Charles, and Merri-

mac river basins in Massachusetts. A gazetteer of the streams of the State is appended.

Ground water in southeastern Nevada, E. Carpenter (*U. S. Geol. Survey, Water-Supply Paper 365 (1915), pp. 86, pls. 5, figs. 3*).—This report deals with the geography, geology, and climate, and the occurrence, amount, distribution, and quality of the ground water of an area of about 17,000 square miles in southeastern Nevada, the topographic features of which consist "of a series of parallel north-south mountain ranges and intervening broad débris-filled valleys." Analyses of 42 samples of the water showed that for domestic use 24 were good, 6 were fair, 8 were poor, 3 were bad, and 1 was unfit. For irrigation use 31 were good, 5 were fair, and 6 were poor.

The Navajo country: A geographic and hydrographic reconnaissance of parts of Arizona, New Mexico, and Utah, H. E. Gregory (*U. S. Geol. Survey, Water-Supply Paper 380 (1916), pp. 219, pls. 29, figs. 29*).—This report deals with the geography, climate, and surface and ground waters of the Navajo and Hopi Indian reservations in Arizona, New Mexico, and Utah, covering an area of about 14,333,354 acres.

"Bare rock constitutes a large proportion of the surface of the Navajo Reservation outside the larger washes. . . . As a whole the soil is, however, mainly accumulated in the washes and along the smaller stream channels, where deposits exceeding 50 ft. in depth are not unusual." These alluvial deposits have a composition almost wholly of sand and gravels.

"By methods of flood irrigation the Navajo and Hopi together cultivate about 20,000 acres of land widely distributed over the reservation in fields about 3 acres in average size, rarely exceeding 200 acres. Considering the size of fields, the nature of the soil, the fluctuating flow of streams, and the large amount of débris carried in the flooded channels, this method of control by inexpensive dams, rebuilt each season, is satisfactory, but the amount of water lost is enormous." With reference to irrigation by storage, it was found that "the storage grounds along the perennial streams of the Chuska Mountains and of the Carrizo and Navajo mountains are at altitudes which prohibit the cultivation of crops other than those which survive large ranges in daily temperature and can endure frost at any month in the year. Water from reservoirs thus located must be carried 10 to 30 miles before it can reach large tracts suitable for general agriculture. In general the largest tracts of irrigable land are farthest from permanent streams. The deeper canyons—Navajo, Piute, Laguna, upper Moenkopi, Del Muerto, and others now occupied by streams—contain little arable land. The construction of dams for storage of flood water in the wide alluvium-filled washes presents engineering difficulties surmountable only at prohibitive cost, a statement amply supported by a formidable catalogue of failures. The amount of silt carried along the large valleys is sufficient to cause embarrassment. . . .

"The alluvial filling of washes and canyons is, in general, fine and coarse sand rather than silt and clay; the soil absorption and underground flow is correspondingly large." "Tests were made of flood water taken from the larger washes and allowed to settle from 12 to 36 hours. Eight such tests gave an apparent percentage of sediment ranging from 6 to 25. One record of 34 per cent was obtained, and a sample taken from a tributary of the Little Colorado was found after 16 hours to have deposited nearly half its bulk."

Special sections on domestic and stock water supplies are also included. An extensive bibliography on the region is appended.

Harney and Silver Creek projects, irrigation and drainage, J. T. Whistler and J. H. Lewis (*Oreg. Cooper. Work, Dept. Int. U. S. Reclamation Serv., 1916, Feb., pp. 91, pls. 24*).—This report, prepared in cooperation with the State of

Oregon, "deals with irrigation possibilities of the Harney basin region, but more especially with the development of Harney Valley and Silver Creek Valley. . . .

"The features to which the Harney report has special reference are (1) irrigation development in Harney Valley by the storage and use of water from Silvies River to include, first, the higher development of approximately 60,000 acres gross area of land now under a crude flood system of irrigation from Silvies River, by complete storage control and a more scientific use of their water supply; second, the irrigation of approximately 40,000 acres additional land not now reached by Silvies River diversions, through storage of water now wasted; and (2) Blitzen Valley development and the possibility of using Blitzen River water for the irrigation of a part of Harney Valley, together with the possible drainage and irrigation of a part of Malheur Lake bed. . . .

"The features to which the Silver Creek report has special reference are (1) irrigation development of new lands in Silver Creek Valley and Warm Springs Valley by the storage and use of water now wasted from Silver Creek into Harney and Silver lakes, and the higher development of lands already irrigated; and (2) the possibilities of further development in Warm Springs Valley by pumping and storage, to promote a better utilization of the Warm Springs flow."

Artesian water for irrigation in Little Bitterroot Valley, Montana, O. E. Meinzer (*U. S. Geol. Survey, Water-Supply Paper 400 B (1916), pp. 9–37, pls. 4, figs. 4*).—This paper deals with the physiography and geology of an area of about 385,000 acres in northwestern Montana and reports an investigation of the occurrence, head, yield, and quality of the artesian water in the area, with special reference to its use for irrigation.

"The principal artesian-water bed lies about 300 ft. below the lake plain, or somewhat more than 200 ft. below the level of Little Bitterroot River. . . . Flowing wells can be obtained over about one-fifth of Little Bitterroot Valley. . . .

"In general the level to which the water from the artesian bed rises is considerably above the water level in dug wells that end at higher horizons. On the bottom lands, where the water table nearly coincides with the river level, the difference is greatest and amounts to a maximum of about 70 ft. Under the lake plain at some distance from the river the water table is considerably above river level, and the difference is not so great. In some places where there is perched water . . . the water table may stand higher than the level to which the artesian water will rise. . . . The flowing wells in Little Bitterroot Valley interfere with each other, the effect being most noticeable in wells with slight head when other wells are drilled near by at considerably lower levels. . . .

"The ground waters in Little Bitterroot Valley are not highly mineralized, the samples examined ranging in total dissolved solids from 180 to 480 parts per million. They are nearly all sodium carbonate waters, and most of them have an odor of hydrogen sulphid, but they differ considerably in mineral content and in this respect fall into two or more groups. The deep artesian waters . . . are very low in calcium and magnesium and relatively high in sodium; they are relatively high in bicarbonate, moderate in chlorin, and very low in sulphate. . . . A notable feature of the artesian water is its high temperature. The water from a few of the wells is hot, though that from other wells has a normal temperature or a temperature slightly above normal. . . .

"Jetting or hydraulic drilling rigs are now used in Little Bitterroot Valley and are well adapted to the conditions that prevail there. In those rigs water pumped down through hollow drill rods comes up on the outside and cutting drill bits are operated by the spudding method. . . . In 1915 the prevailing

prices, including casing, were about $1 per foot for wells with 3-in. casing, $1.25 for wells with 4-in. casing, and $1.50 for wells with 5-in. casing. . . .

"Development of irrigation supplies from flowing wells is practically limited to the river bottom lands and the lowest bottom lands in the Hot Springs Creek drainage basin. Artesian supplies can be obtained on the bottom lands in considerable quantities at low cost, but on the higher lands in only small quantities and at very high cost for irrigation."

The alkali content of irrigation waters, R. STEWART and C. T. HIRST (*Utah Sta. Bul. 147 (1916), pp. 3–18, fig. 1*).—Analyses are reported of samples of water from six streams in Utah, showing the average amounts of the various salts added to the soil by an acre-foot of irrigation water as given in the following table:

Average amounts of salts added per acre by 1 acre-foot of irrigation water.

Name of stream.	Number of analyses.	Total salts.	Sodium.			Calcium.	Magnesium.		
			Nitrate.	Chlorid.	Sulphate.	Bicarbonate.	Bicarbonate.	Chlorid.	Sulphate.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Price River	4	2,119.5	3.3	8.1	219.6	840.9	388.2	12.2	548.1
Huntington Creek	2	1,609.5	7.3	2.7	250.3	816.1	191.7	25.8	463.0
Coal Creek	3	902.9	3.1	59.9	76.1	601.9	121.6	16.3	286.2
Sevier River	10	3,272.4	22.0	646.8	121.4	881.4	116.1	74.8	817.6
Ferron Creek	1	1,990.0	10.9	6.3	144.1	1,014.5	106.0	....	666.3
Emery Creek	1	1,055.0	8.2	.0	.0	688.0	179.0	10.3	138.7

The following conclusions are drawn:

"The mere determination of the total salts present in irrigation water is not adequate in judging the quality of the water for irrigation. The determination of total salts is valuable as a check on the analysis.

"A large part of the soluble salts of irrigation water consists of the harmless bicarbonates of calcium and magnesium. In some instances these salts constitute 50 per cent of the total amount present. The soluble salts present in irrigation water vary from time to time due to concentration by evaporation, to drainage from the surface soil during storms, and to seepage from the irrigated lands and canals.

"The waters of Price River and Huntington Creek are highly charged with harmful alkali salts and must be used very judiciously on the heavy clay soils of Castle Valley, which are already heavily charged with sulphates of sodium and magnesium. The waters of Coal Creek are excellent for irrigation since they contain only minimum quantities of harmful salts. The economical use of such water will not add excessive quantities of harmful alkali salts to the soil. The waters of the Sevier River are heavily impregnated with the harmful chlorids and sulphates of sodium and magnesium. The waters of this stream are such that their continued use without artificial drainage on the heavy clay soils of Millard County is likely to cause trouble. The waters of all the streams examined are free from sodium carbonate or black alkali, possibly due to the fact that all the streams traverse country rock which is rich in deposits of gypsum."

Tests of irrigation pumping plants, R. H. CATES. (*Jour. Electricity, 37 (1916), No. 21, pp. 394, 395*).—The results of over 300 separate tests of irrigation pumping plants made in California during 1913 to 1916 are reported, together with the results of tests of typical plants. A summary of the results is given in the table following.

Summary of results of tests of irrigation pumping plants.

Type of pump.	Size of pump.	Mean discharge, miner's inches.	Mean total lift.	Number of tests.	Mean efficiency of pump.	Mean overall efficiency of plant.	Mean miner's in. pumped per kw. of input per 100 ft. lift.	Kw. hours used to lift 1 acre-foot 1 ft.
	Inches.		*Feet.*		*Per ct.*	*Per ct.*		
Vertical centrifugal	2.5	10	119	2	30.0	23.3	1.38	4.4
	3.0	17	84	9	33.0	26.6	1.57	3.9
	4.0	50	88	28	46.8	38.1	2.25	2.7
	5.0	64	75	51	47.8	39.4	2.33	2.6
	6.0	106	83	54	54.8	45.6	2.69	2.2
	7.0	131	83	21	56.5	48.6	2.87	2.1
	8.0	241	83	9	64.4	51.6	3.05	2.0
	10.0	360	110	2	60.8	51.0	3.01	2.0
Horizontal centrifugal	2.0	13	41	2	34.0	27.4	1.62	3.7
	3.0	28	90	3	40.4	33.8	1.99	3.0
	3.5	58	71	2	56.0	47.7	2.81	2.1
	4.0	54	129	6	54.6	46.5	2.74	2.2
	5.0	38	45	1	52.5	42.2	2.49	2.4
	6.0	86	174	3	51.9	44.5	2.63	2.3
	7.0	170	44	1	54.0	45.0	2.65	2.3
	8.0	226	131	9	60.9	53.1	3.13	1.9
	12.0	325	42	3	55.4	47.7	2.82	2.1
Well turbines	10.0	71	134	5	56.0	47.3	2.93	2.2
	12.0	63	94	25	49.7	40.5	2.39	2.5
	14.0	80	55	4	39.5	32.6	1.92	3.1
	15.0	84	113	8	50.1	41.4	2.45	2.5
	16.0	103	47	2	51.8	42.8	2.53	2.4
	20.0	142	88	2	54.8	41.5	2.45	2.5
	24.0	115	130	9	55.6	46.6	2.75	2.2
Propeller	....	116	61	21	43.3	35.7	2.11	2.9
Piston pump:								
Deep well type	....	28	189	7	58.9	48.0	2.84	2.1
Duplex	....	129	235	2	79.6	71.7	4.23	1.4
Triplex	....	83	147	7	79.6	66.7	3.94	1.5
Air lifts	....	42	123	7	27.4	23.1	1.36	4.4

Experiments with submerged orifices and tubes, T. C. Rogers and T. L. Smith (*Engin. News, 76 (1916), No. 18, pp. 825–827, figs. 3*).—Experiments conducted at Cornell University on the flow of water through orifices 6, 8, and 10 in. square under heads up to 2.2 ft. are reported. The length of the tube was varied, but square edges at the entrance were used throughout.

"Curves were plotted between discharge coefficient and head for each length of tube and also between average discharge coefficient and length of tube, the latter being expressed as the ratio of tube length L to the side of the square orifice D. The curves plotted showing variation of discharge coefficient with head indicate that in most cases there is a slight increase in coefficient with higher heads. This increase is not pronounced, however, except in one or two curves, and in some cases there seems to be a decrease in the coefficient with higher heads. . . .

"The general conclusion may be drawn from these experiments that annexing a tube to a submerged square orifice will greatly increase its flow under a given head until the length of tube is equal to about 1.5 times the side of the square. A longer tube will not decrease the flow, unless the friction is large, but it will not materially increase it. For free discharge into the air the coefficient does not vary, but remains at about 0.61, whatever the tube length. This value is about 0.67 per cent greater than the submerged sharp-edge coefficient, and corresponds to the submerged coefficient for $L/D=0.05$. From this it follows that, given a square orifice with a tube attached and a fixed head of water upstream, a greater quantity may be made to flow through the orifice by submerging the downstream side than will flow if the orifice discharges into the air. This fact was verified by experimentation."

The significance of streptococci in water supplies, W. G. SAVAGE and W. J. READ (*Jour. Hyg. [Cambridge], 15 (1916), No. 3, pp. 334–351*).—Experiments with deep-water supplies, including samples from springs and deep wells, and with surface-water supplies, including samples from shallow wells, are reported. The purpose was to determine the relation of the presence or absence of streptococci to the quality of the water.

It was found that the results of analyses studied in bulk and the results of detailed consideration of individual supplies were essentially the same. The absence of streptococci is considered of less significance than their presence, and even their absence from a considerable bulk of water is not accepted, to the same extent as the absence of *Bacillus coli*, as reliable evidence of the freedom from serious contamination of the water at the time of sampling. Absence of streptococci is, however, considered a point in favor of the purity of the water.

"Standards for permissible number of streptococci broadly correspond to similar numerical standards for *B. coli*, but are of less significance and reliability." While it is thought that not enough is known about the varying vitality and distribution of streptococci to say whether the presence of certain strains may or may not be disregarded as evidence of excretal contamination, it is concluded to be in general reliable to assume that streptococci in large numbers are only present in waters from unsatisfactory sources.

Results and conclusions from a year's operation of the activated sludge sewage treatment plant of Milwaukee, T. C. HATTON (*Engin. and Contract., 46 (1916), No. 19, pp. 407–409*).—The results of experiments on securing activated sludge, aeration, effect of low temperatures, sedimentation, and sludge disposal are reported. With reference to sludge disposal it is concluded that there is no difficulty in reducing the Milwaukee sludge to a marketable low-grade fertilizer at less than its value. See also a previous report of experiments (E. S. R., 35, p. 188).

Public road mileage and revenues in the New England States, 1914 (*U. S. Dept. Agr. Bul. 388 (1917), pp. 74*).—This is a compilation showing the mileage of improved and unimproved roads, sources and amounts of road revenues, and bonds issued and outstanding, and contains a description of the systems of road administration, fiscal management, and other factors affecting road improvement in each State.

Report of the State Commissioner of Highways [of New York], E. DUFFEY (*Rpt. State Com. Highways, N. Y., 1915, pp. 939, pls. 49*).—This is a report of the work and expenditures on highway construction, maintenance, and repair in New York for 1915.

Proposed motor-truck loads for highway bridges, O. W. CHILDS (*Engin. News, 76 (1916), No. 19, pp. 898, 899, fig. 1*).—It is stated that motor trucks are the proper form of concentrated loads to specify in the design or investigation of rural highway bridges. "A typical truck is assumed to have two axles spaced 10 ft. on centers, with the two wheels on each axle spaced 5 ft. on centers. This truck covers a space 9 ft. wide by 20 ft. long, symmetrical about the truck center. One-third of the weight is on the front axle, two-thirds on the rear axle. With this standard size and distribution the capacity may be definitely and simply expressed as the total weight in tons of the loaded truck." Diagrams giving maximum shears and moments covering the range from 5- to 24-ton trucks and spans up to 50 ft. are given.

The following table for 10-ton trucks may be used for any weight, as the values vary in direct ratio with the weight.

Maximum shears and bending moments for typical trucks.

[Values for two wheels on one side.]

Span.	Ten-ton truck.		Span.	Ten-ton truck.		Span.	Ten-ton truck.	
	Shear.	Moment.		Shear.	Moment.		Shear.	Moment.
Ft.	*Lbs.*	*Ft.-Lbs.*	*Ft.*	*Lbs.*	*Ft.-Lbs.*	*Ft.*	*Lbs.*	*Ft.-Lbs.*
5	6,666	8,333	21	8,412	37,154	36	9,074	74,065
6	6,666	10,000	22	8,486	39,594	37	9,100	76,584
7	6,666	11,666	23	8,552	42,040	38	9,124	79,094
8	6,666	13,333	24	8,612	44,488	39	9,146	81,546
9	6,666	15,000	25	8,668	46,942	40	9,168	84,048
10	6,666	16,666	26	8,718	49,401	41	9,188	86,511
11	6,970	18,333	27	8,766	51,833	42	9,208	88,993
12	7,222	20,000	28	8,810	54,325	43	9,226	91,477
13	7,436	21,666	29	8,852	56,791	44	9,244	93,965
14	7,622	23,333	30	8,890	59,259	45	9,260	96,451
15	7,778	25,000	31	8,926	61,740	46	9,276	98,946
16	7,918	26,666	32	8,958	64,201	47	9,292	101,424
17	8,040	28,333	33	8,990	66,675	48	9,306	104,012
18	8,148	30,000	34	9,018	69,150	49	9,320	106,400
19	8,246	32,294	35	9,048	71,627	50	9,334	108,889
20	8,334	34,721						

"Bridges on improved roads should as a rule be designed for 15-ton typical trucks, but other capacities may be necessary for special conditions. . . . In general, impact allowance should not be less than 30 per cent of the static stress, but it should be varied to fit conditions."

Tractive resistances to a motor delivery wagon on different roads and at different speeds, A. E. KENNELLY and O. R. SCHURIG (*Proc. Amer. Inst. Elect. Engins., 35* (*1916*), *No. 6, pp. 1011–1039, pl. 1, figs. 17; Mass. Inst. Tech., Elect. Engin. Dept., Research Div. Bul. 10* (*1916*), *pp. 1011–1039, pl. 1, figs. 17; abs. in West. Engin., 7* (*1916*), *No. 11, pp. 434, 435, fig. 1*).—The results of an investigation conducted at the Massachusetts Institute of Technology on the tractive resistance of asphalt, wood block, brick block, granite block, water-bound macadam, cemented joint granite block, tar macadam, cinder, and gravel pavements in conditions varying from extremely poor to good are reported.

The vehicle used was a worm-drive single-reduction electric truck having a capacity of 1,000 lbs. The overall length of the frame was 168½ in., the width 35 in., the wheel base 107⅝ in., and the wheel gage 58 in. Solid-rubber demountable tires measuring 2½ by 36 in. were used on all four wheels. The truck was equipped with a direct-current series-motor. The length of runs in the road tests ranged between 400 and 2,600 ft.

It was found that "the overall efficiency of the test-truck mechanism, between battery terminals and rear-wheel treads, reached a maximum value of about 78 per cent, under the most favorable conditions. The mechanical efficiency of transmission from motor shaft to rear-wheel treads, for the truck tested, shaft-driven through a single-reduction worm gear, was found to be as high as 90 per cent.

"Tractive resistances are most conveniently expressed as an equivalent grade; that is, a level road of definite tractive resistance may be regarded as a road of zero tractive resistance, but rising uniformly x units in 100 units of road length, or having an equivalent grade of x per cent. Under the conditions of these tests, the tractive resistance on level roads, in the absence of wind, is composed of (1) displacement resistance, (2) impact resistance, and (3) air resistance.

"The displacement resistance varied from 0.85 per cent equivalent grade for a hard, smooth asphalt or bituminous concrete to 1.6 per cent for a soft tar-

macadam road, and was practically constant, for all speeds considered, on any given road. The impact resistance increases with the velocity, with the total weight of vehicle, and with increasing road-surface roughness. In these tests the impact resistance of good asphalt or bitulithic or other smooth pavement was practically negligible, and reached its highest values on granite-block roads with sand-filled joints, and on badly-worn macadam pavements. The rate of increase of impact resistance with speed was most marked on the roughest roads.

"At the vehicle speed of 20 km. (12.4 miles) per hour, the air resistance for the vehicle tested, assumed to be dependent only on the speed, was roughly 0.11 per cent equivalent grade; that is, from 4 per cent of the highest to 12.5 per cent of the lowest total tractive resistance.

"The following pavements are enumerated in the order of their desirability for vehicle operation from the point of view of tractive resistance at 20 km. per hour, as found in this investigation: Asphalt, wood block, hard, smooth macadam, brick block, granite block with cement-filled joints, cinder, gravel, and granite block with sand-filled joints.

"The equivalent grade at 20 km. per hour of a badly worn macadam road was found to be nearly three times as great as that of the best asphalt road tested. This means, at this speed, a consumption of energy at wheel treads of nearly three times as much on level, poor macadam roads as on level, good asphalt roads. Increasing the gross weight of the vehicle by 12 per cent through load was found to have no effect on tractive resistance within the observed speed limits for smooth roads in good condition; but on rough roads, a distinct increase in tractive resistance with this extra weight was observed. The presence of a layer of dust, say 1 cm. thick, on a fair macadam road, was found to increase the equivalent grade of tractive resistance at all tested speeds by about 0.15 per cent. A freshly tarred, and therefore soft, tar-macadam road was found to have an increased equivalent tractive resistance at substantially all tested speeds of about 0.5 per cent. The tires in this case sank about 0.8 in. into the roadbed, the gross car weight being 4,710 lbs. The total range of tractive resistance equivalent grade covered in the tests was from 0.93 per cent on the best asphalt road at lowest speed to 2.7 per cent on the worst macadam road at nearly the highest speed."

First national farm tractor directory, compiled by C. E. STONE (*New York: The Agricultural Press, 1916, pp. 8*).—This is a complete list of farm tractors, their manufacturers, horsepower, type, traction, and other particulars.

Modern systems of independent lighting and heating (*Nature [London], 96 (1916), Nos. 2410, pp. 522–524, figs. 5; 2411, pp. 552, 553, figs. 3; 2412, pp. 577, 578, fig. 1*).—Oil, oil gas, petrol air gas, acetylene, and electric lighting systems for country homes are described and illustrated.

RURAL ECONOMICS.

The farmer's labor income, P. L. VOGT (*Amer. Econ. Rev., 6 (1916), No. 4, pp. 808–822*).—After discussing the data available from the various studies in connection with the Office of Farm Management of the U. S. Department of Agriculture as to the farmer's labor income and additional information as furnished by the Census, the author concludes as follows:

"The data presented indicate that, while at the present time labor incomes of farmers compare favorably with those in urban industries, the institution of private ownership of land does not offer much hope for further increase of these incomes unless the system of owner operation can be preserved. Laborers are evidently not benefiting by the economic changes taking place. Tenants

are nominally getting the larger incomes; but this apparent return is due to method of presentation of returns rather than to actual advantage. The uniformity of labor incomes throughout the entire area studied indicates that private ownership of land by absentee landlords who reap the benefit of such ownership, even though absent in the neighboring village, is bound to become a question of supreme importance in the future. . . .

"The problem of farm incomes is not now a serious one as related to social welfare in the country; but if present tendencies continue it is bound to be a serious one for those actually living in the country in the future. If one-half or one-third of the wealth produced on a given farm is to go to others than the operator; if farm labor is to increase because of the lack of opportunity to gain a foothold, due to high land values; then we must expect that the great central valley, one of the greatest agricultural sections of the world so far as resources is concerned, will be doomed to bear a burden that will breed discontent; that will drive our young men and women from the country; and will bring to America problems that now confront other nations in which statesmen recognize that a good income for farmers and ownership operation are essential to national welfare."

Labor income does not determine true profits, J. I. Falconer (*Agr. Student, 23* (*1916*), *No. 2, pp. 104–106*).—The author considers that "labor income is a fair basis upon which to compare one farm with another, but it does not afford a fair basis for comparison between the profits of farming and those in other occupations. It is a good basis upon which to compare two farms in a community, one operated, for example, as a grain farm, the other operated as a live-stock farm, or with which to compare a corn and hog farm with a dairy farm. But it is not a measure of the profits in agriculture, nor would the average labor income of a farm for a series of years be a criterion of the size of the estate which a farmer would probate at the time of his decease."

Farm profits (and factors influencing profits) on 370 potato farms in Monmouth County, New Jersey, F. App (*New Jersey Stas. Bul. 294* (*1916*), *pp. 3–103, pls. 8, figs. 10*).—Among the conclusions arrived at from this study, conducted in cooperation with the Department of Conservation and Development of New Jersey and the Bureau of Soils of the U. S. Department of Agriculture, are the following:

"The average labor income for the Monmouth County potato farms included in this survey is $842. The cash tenants have the largest average labor income of $938, while the owners have $917, and share tenants $739. Forty-five per cent of the potato farms are operated by tenants. Cash renting is most profitable for the tenant who is a good farmer. . . . The average farm investment for the owners is $17,673, for the share tenants $3,369, and for the cash tenants $3,085.

"The farm profits increase with the increase of crop acres per farm for both owner and tenant farms. The larger farms are far more efficient in the use of man, horse, and machinery labor than are the smaller farms. . . . Farm and crop acre values decrease as size increases for all farms regardless of tenantry. . . . The average sized farm for the owners is 73 crop acres, and for the tenants 87 crop acres. . . .

"The acre cost of producing potatoes is $85.15. The cost per barrel is 92 cents. Farmers producing 60 barrels or less per acre lose money. No class of farmers are raising higher yields of potatoes than are profitable. . . . The larger the proportion of crop acres in potatoes the greater is the labor income. . . . Lack of rotation is not decreasing potato yields, and live stock above what is needed for the farmer's personal use is not profitable on most farms. . . . Diversification lowers profits on these farms.

"The proportion of crop acres in potatoes decreases with distance from the railroad. After a distance from the railroad of four or more miles has been reached, potatoes show a low return. . . . Cooperative buying and selling has proved very successful in this region."

Factors affecting methods of farm management in the North Island, J. Brown (*Jour. Agr. [New Zeal.], 13 (1916), No. 1, pp. 1–16, pl. 1, figs. 2*).—The author summarizes his observations regarding farm management in this community as follows:

"Good pasture is the mainstay of the North Island farmer. Most good pastures may be further improved in nutritive value by periodic applications of crushed limestone. Inferior pasture everywhere should be renewed by liming, cropping, manuring, and re-grassing after a second application of crushed limestone. . . . On light land these successive stages of improvement should automatically bring about a rotational system, including growth of oats, inexpensive forage crops, and pastures of longer or shorter duration, according to circumstances. If lucern can be grown, the maximum of profits can not be realized without it. Beyond a very narrow limit, profits recede as cultivation extends and pasture areas are reduced."

[Agricultural laws of North Dakota] (In *Compilation of Laws of the State of North Dakota Governing Railroads [etc.]. Bismarck: Bd. R. R. Comrs., 1915, pp. 93–109*).—Among the laws included in this compilation are those relating to cooperative associations, grain warehouses, and commission merchants.

The Federal Farm Loan Act (*U. S. Treas. Dept., Fed. Farm Loan Bd. Circ. 4 (1916), pp. 29*).—This circular contains the complete text of the act.

Digest of the Federal Farm Loan Act (*New York: Guaranty Trust Co., 1916, pp. 16*).—This digest endeavors to give a comprehensive idea of this act by pointing out its salient features.

[Agricultural credit in British India and Netherland East Indies], J. Douie and H. C. Alting (*Trans. 3, Internat. Cong. Trop. Agr. 1914, vol. 1, pp. 95–124*).—The authors describe the types of credit institutions, the problems in connection with their establishment and development, the methods of management, and some of the results obtained.

[Annual reports of the marketing commissioners], J. F. Smith, W. E. McTaggart, and R. C. Abbott (*Brit. Columbia Dept. Agr. Ann. Rpt., 10 (1915), pp. R54–R73, R126, R127, pls. 6*).—These reports relate to the work of the marketing commissioners in western Canada and describe their activities in assisting in the marketing of fruit and vegetables, the standardization of packages, and the reorganzation of city markets. The reports also indicate the size of packages preferred by the trade and the size of boxes and crates used in marketing fruits and vegetables.

Relation between primary market prices and qualities of cotton, F. Taylor (*U. S. Dept. Agr. Bul. 457 (1916), pp. 13*).—This report is the result of a survey made in 73 towns located in 9 cotton-growing States, including the examination of 38,000 representative samples, to determine whether, in the same market, cotton was purchased on averages, all grades bringing the same price.

The report indicates that from such evidence as was gathered either higher grades are being priced too low or that the lower grades are bringing prices above their value, or that a combination of the two is true. The average price paid for cotton of $\frac{7}{8}$-in. staple was as high as for 1-in. staple. It also appears that in the eastern belt higher prices are being paid, due to the proximity to the cotton mills, absence of most of the middlemen, and to the facts that primary marketing conditions are superior, storage houses are more generally available, money rates are comparatively lower, and competition probably exists to a greater degree than in the West.

In order to improve the quality of the cotton and to obtain its true worth, the author recommends that the farmer be convinced of the importance of producing good staple and of care in picking and housing it, and that adequate but not excessive covering for the bale be supplied to protect the lint. He considers that proper storage after ginning would prevent the country damages from assuming such large proportions. He also recommends the organization of cooperative associations for the proper handling and marketing of cotton.

Advertising the apple, F. C. Sears (*Mass. Agr. Col. Ext. Serv. Bul. 10 (1916), pp. 3–20, figs. 8*).—This publication points out methods of advertising and agencies which might be interested in an advertising campaign and the part which each one would be expected to play. A number of typical illustrations are included.

Minnesota, the center of northwestern agricultural development.—Saint Paul, the northwestern market for diversified farming (*[St. Paul]: St. Paul Assoc. Com., 1916, pp. 42, figs. 29*).—This publication was compiled for presentation to the Federal Farm Loan Board, and sets forth the advantages of St. Paul as the agricultural and financial center for the States of Minnesota, North Dakota, South Dakota, and Montana.

Minneapolis "the market of the northwest" (*Minneapolis: Minn. Civic and Com. Assoc. [1916], pp. 166, pl. 1, figs. 90*).—This report, compiled for presentation to the Federal Farm Loan Board, sets forth the advantages of Minneapolis as the center through which the Northwest sells its produce, purchases its supplies, and carries on its banking business.

[Raleigh as the location of a Federal farm loan bank], W. A. Withers (*Raleigh, N. C.: Com. Representing Raleigh, 1916, pp. 2+59, figs. 18*).—This report points out the advantages of Raleigh as a center of agricultural production and the rural interests of North Carolina and the surrounding States, and the reasons for the establishment of a Federal farm loan bank in that city.

[Agriculture in North Carolina] (*Univ. N. C. Rec., No. 140 (1916), pp. 93*).—This is a report of the North Carolina Club, which comprises the students and members of the faculty of the University of North Carolina who are studying conditions in their State. It contains a series of papers presented before the club relating to the natural resources of the State.

Reports from the seed and plant distribution (*Alaska Stas. Rpt. 1915, pp. 82–93, pls. 5*).—The usual extracts from letters of settlers and other persons, telling of their success with various crops and live stock and describing the possibilities and drawbacks in Alaska, are presented.

Agricultural statistics, Ireland, 1916, T. Butler (*Dept. Agr. and Tech. Instr. Ireland, Agr. Statis. 1915–16, pp. 29*).—This report includes a summary statement by counties and provinces of the area devoted to the principal crops and the number of live stock.

[Agricultural statistics in Germany] (*Viertelj. Statis. Deut. Reichs, 25 (1916), No. 2, pp. II. 43–II. 73*).—These pages contain statistical data showing for the minor subdivisions the number of the various kinds of live stock and the area and production of the principal crops for 1915, with comparative data for earlier years.

Agriculture in India, J. Mackenna (*Calcutta: Govt., 1915, pp III+106, pl. 1*).—The author gives a brief historical treatment of the development of agriculture in India, describes the estblishment of the Agricultural Research Institute at Pusa, and the organization and work of the provincial departments of agriculture. He also discusses the distribution of the various agricultural crops and their relation to the national development of the country.

AGRICULTURAL EDUCATION.

Report of agriculture in the high schools of Michigan, W. H. French (*Mich. Agr. Col., Dept. Agr. Ed. Bul. 16 (1916), pp. 20, figs. 12*).—This is a report on the progress of agricultural instruction in the high schools of Michigan. It discusses the plan of the courses, special educational features or community work, summer employment of the agricultural teacher, special summer projects, cooperation with the county agent, etc. The agricultural units, which require 25 per cent of the student's time, consist of botany in the ninth grade, farm crops and horticulture in the tenth, animal husbandry in the eleventh, and soils and farm management in the twelfth.

In 1915–16, 44 high schools employed college-trained instructors, and 12 employed instructors with less than college training; 14 high schools have developed full four-unit courses, 12 gave four units of work alternating the last two years, and 19 gave two-unit courses. The number of students enrolled in agricultural subjects was 2,574; 140 students graduated from 4-year courses in agriculture; 600 students conducted summer-home projects, including the raising of corn and potatoes, keeping records of a dairy herd, pruning, spraying and renovating orchards, and raising poultry and swine; 1,054 conducted home-garden work, and while in some places school gardens were conducted on the community plan, individual home gardens are proving most satisfactory. Fourteen instructors were employed for the 12 months in the year, and 19 gave instruction in the elementary grades.

Twelve high schools introduced the agricultural course in 1916. Among the special features of community work undertaken by various agricultural instructors may be mentioned special Saturday and evening classes for rural teachers; evening classes in agriculture and chemistry for farmers; a farm survey along the lines of actual conditions in farm management; a township live-stock census; a special course in dairying for farmers; and, in cooperation with the agricultural college, the distribution of pure seed to farmers, demonstration work, and the organization of horticultural societies and live-stock associations.

A list of the schools and teachers giving instruction in agriculture in 1916–17 is included.

The work of the college of agriculture, E. B. Copeland (*Philippine Agr. and Forester, 5 (1916), No. 1, pp. 36*).—This is a detailed report on the work of instruction, demonstration, and investigation in botany, chemistry, entomology, agricultural engineering, agronomy, and animal industry, and on the personnel, land and buildings, and equipment of the college of agriculture at Los Baños.

The Agricultural Instruction Act (*Agr. Gaz. Canada, 3 (1916), No. 9, pp. 776–780*).—This article gives the text of the agreement entered into between the Minister of Agriculture for Canada and the minister of agriculture of each of the nine Provinces of the Dominion under the provisions of the Agricultural Instruction Act setting forth the appropriation to each Province and the work to be undertaken for the fiscal year ending March 31, 1917. It is shown that of the total appropriation of $1,000,000 nearly $100,000 will be devoted to agricultural instruction in the rural and higher public schools, about $259,000 for agricultural colleges and schools, $20,000 for veterinary colleges, and about $46,000 for women's work.

Agricultural education and live stock improvement in Wales (*Jour. Bd. Agr. [London], 23 (1916), No. 3, pp. 260–263*).—An account is given of the development of agricultural education in Wales in connection with local education authorities and in the agricultural departments of the agricultural colleges since 1911–12.

In consequence of the Development Fund the year 1912–13 marked the beginning of a new era in the history of agricultural education in Wales as regards public administration and financial assistance. Prior to 1912–13 the cost of the work was practically borne by the counties themselves, their total expenditure for the three years ended March 31, 1912, averaging $30,054, while the agricultural colleges at Aberystwyth and Bangor each received $5,832, and the latter also $1,215 for forestry instruction. For the year ended March 31, 1915, the total estimated county expenditure was $60,040, that to Aberystwyth college $12,670, and that to Bangor college $20,042.

The farm institute scheme became operative in the Welsh counties generally in 1914–15. Only two counties, Carnarvon and Monmouth, have taken steps to provide special institutions for agricultural instruction, the other 11 counties deciding to continue to work, for the time being at least, in direct association with the agricultural departments of the two colleges as before. The county schemes vary somewhat in character, but generally provide for (1) courses at local centers in agriculture, horticulture, dairying, poultry management, veterinary hygiene, and other subjects conducted by a staff employed directly by the county or through the agricultural department of one of the colleges, (2) field experiments and demonstrations in manuring, new varieties of crops, seed mixtures, etc., and (3) systematic courses in agriculture and dairying for farmers' sons and daughters, aided by scholarships and exhibitions at either one of the university colleges or county institutions where the latter exist. The additional sums to the agricultural departments of the colleges have made more scholarships available, they now incur no expenditure for purely county work, and they have appointed special officers to give technical advice to farmers and to investigate local problems, live-stock officers, and advisers in agricultural botany and chemistry.

Instruction in light farm work and milking for women and children (*Jour. Bd. Agr. [London], 23 (1916), No. 3, pp. 264–271*).—Brief summaries are given indicating the provision made by various county authorities for instruction in light farm work and milking for women and children in England and Wales. The instruction is given at agricultural colleges and farm schools, farm institutes, approved farms, etc., and varies in length from two to nine weeks.

Farm mechanics (*Agr. Gaz. Canada, 3 (1916), No. 8, pp. 731–739, fig. 1*).—This is a series of articles containing an account of the instruction in farm mechanics, including outlines of courses of study, methods of instruction, equipment, examinations, etc., in the Nova Scotia College of Agriculture, MacDonald College, Ontario Agricultural College, Manitoba Agricultural College, Saskatchewan College of Agriculture, and the Alberta schools of agriculture.

The kingdom of the plants, C. A. NORCROSS and P. A. LEHENBAUER (*Agr. Ext. Univ. Nev. Bul. 8 (1916), pp. 23, figs. 20*).—This bulletin comprises the first four lessons of a series of 16 in an extension course in gardening for boys' and girls' clubs. These lessons are devoted to definitions of terms in the study of plant life, seeds and how they germinate, plant structure and growth, and the work of plants. Experiments and a list of questions to test the pupils' knowledge of plants are included.

Twenty lessons in domestic science, MARIAN C. FISHER (*Author, 1916, pp. 108, figs. 19*).—This is a condensed home study course in domestic science comprising 20 lessons dealing with food principles, the functions, classification, assimilation, and composition of food, dietary standards, methods of cooking, and recipes and kitchen equipment. A list of Farmers' Bulletins of this department, reference tables, pronunciations and definitions, and other miscellaneous data of value to the housekeeper are appended.

A series of lessons in cooking and household management, Myrtle Hullinger (*Springfield, Ohio: Author, 1916, pp. 416, figs. 5*).—Thirty-eight lessons in cookery and care of the house are outlined by the head of the department of domestic science of the high school in Springfield, Ohio.

An outline on the history of cookery, Anna Barrows, Bertha E. Shapleigh, and Anne D. Blitz (*Teachers Col. [N. Y.] Bul. 11, 6. ser. (1915), pp. 36*).—This outline on the history of cookery is arranged in four parts, viz, prehistoric, ancient, medieval, and modern times, with special references to literature for each part, and a general bibliography, together with suggested topics for individual investigation, either for papers or for class development, at the end of the bulletin.

Clothing for women, Laura I. Baldt (*Philadelphia and London: J. B. Lippincott Co., 1916, pp. XIV+454, pls. 8, figs. 262*).—This manual for the school and home presents the fundamental principles involved in and practical working directions for the selection, design, and construction of clothing for women. The construction of garments is approached from the standpoint of those who have had instruction in elementary sewing, but for others a review of the fundamental stitches and some simple processes have been included in the section on undergarments. Among the subjects treated are clothing budgets and buying, the theory and use of color, and pattern making. A chapter is devoted to instruction to (1) teachers on the use of the text, including the use of illustrative material, suitable equipment, teaching material, and method of instruction, and (2) the home woman and dressmaker.

Shelter and clothing, Helen Kinne and Anna M. Cooley (*New York: The Macmillan Co., 1913, pp. XV+377, pl. 1, figs. 159*).—This textbook, intended for high and normal school students, as well as for the home maker, deals with the home, its ideals in organization, its sanitation, decoration, and furnishing; also with textiles, sewing, dressmaking, economics of dress, and millinery. Practical exercises are appended to each topic and suggestions are offered to teachers on presenting the text.

Food and health, Helen Kinne and Anna M. Cooley (*New York: The Macmillan Co., 1916, pp. VI+312, pl. 1, figs. 138*).—This is an elementary textbook of home making, written in story form. It "treats largely of food problems, including something of raising food and selling it, in addition to the preparation of food at school and at home. Such topics as the water supply, disposal of waste, and other sanitary matters are woven in with the lessons on nutrition and cookery." The work is outlined in 29 lessons, including exercises and problems and a number of simple recipes.

A course in household arts, I, Loretto B. Duff (*Boston: Whitcomb and Barrows, 1916, pp. XVI+301, figs. 21*).—This course is the outgrowth of a course in household arts prepared in 1902 and in general use for many years in the Boston public schools of cookery. It consists of two parts, each containing material for one lesson a week for a year, thus covering the essentials of the course in two years. This book, or part 1 of the course, is designed primarily for beginners, and deals with the fundamental principles underlying the methods employed in cookery and other household arts, including only simple experiments which can be performed with utensils found in the ordinary school kitchen.

MISCELLANEOUS.

Report of Alaska Stations, 1915 (*Alaska Stas. Rpt. 1915, pp. 100, pls. 19*).—This contains the organization list and a report of the several lines of work

carried on during the fiscal year ended June 30, 1915. Meteorological data and accounts of the extensive tests with field and garden crops, live-stock operations, and other lines of work are abstracted elsewhere in this issue.

Twenty-seventh Annual Report of North Dakota Station, 1916 (*North Dakota Sta. Rpt. 1916 [pt. 1], pp. 21, figs. 3*).—Part 1 of this report contains the organization list, a report of the director, and a financial statement as to the Federal funds for the fiscal year ended June 30, 1916. The experimental work reported is for the most part abstracted elsewhere in this issue.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 4 (1916), Nos. 9, pp. 16, figs. 3; 10, pp. 16, figs. 3*).—These numbers contain brief articles on the following subjects:

No. 9.—The Winter School, by W. A. Linklater; The Use of Fertilizers to Increase Crop Production, by E. B. Stookey (see p. 425); Suggestions in Potato Growing, by J. L. Stahl; and Concerning Poultry Feed Values, by Mr. and Mrs. G. R. Shoup (see p. 473).

No. 10.—Standardizing of Land Clearing, by I. D. Charlton; Reducing the Cost of Milk Production, by H. L. Blanchard (see p. 473); Dairy Farm Cropping System, by E. B. Stookey; Rhubarb Culture, by J. L. Stahl; Canker, Chicken Pox, and Roup, by Mr. and Mrs. G. R. Shoup; A New Phase of the Raspberry Rust, by A. Frank; and Some Meat-curing Methods.

Principles on which should be established the mutual relations of experimental and extension institutions, I. V. Emelianov (*O Nachalakh, na Kotorikh Dolzhni Stroitsia Vzaimootnosheniia Obshchestvennoagronomicheskikh i Opytnikh Organizatsii. Kharkof: Kharkov. Oblast. Selsk. Khoz. Opytn. Sta., 1915, pp. 6*).—The author believes that three systems of organization are possible: (1) The complete fusion of the experimental and extension institutions in program and organization; (2) the partial fusion of the institutions, with separate functions devolving on each of them; and (3) the independent organization of each and a strict distribution of functions. The vitality and value of the local extension work depends on its agreement and close solidarity with experimental studies, but it is thought that in view of the great qualitative difference in the problems and the method of work, the basis of such solidarity should be the independence of each of the institutions and a clear division of the functions of experimentation and instruction. Existing conditions in the region insure the possibility of intercourse and close cooperation of extension workers and experimenters, but it is deemed necessary to develop and maintain in the future ways and means for such cooperation. It is also thought that the district experiment stations should organize a division for the study of the economics of the husbandry of the region.

NOTES

Connecticut State Station.—Howard F. Huber, specialist in market gardening, has resigned to accept a position in the extension service of Rutgers College.

Iowa College and Station.—The new animal husbandry laboratory is nearing completion. It is a one-story building 74 by 112 ft., costing about $50,000. It has been devised especially for work in connection with the slaughtering, dressing, cutting, and curing of meats. The basement contains a 10-ton refrigerating plant, coolers, a smokehouse, refining, sausage, lard, and other by-product rooms, offices, etc. The main floor can be divided into three distinct rooms, or used as a whole for demonstration work.

The recent short course and farmer's week was more largely attended than ever before, the aggregate reaching 3,500. About 400 of these were in the junior work.

A State-wide egg laying contest is being planned by the State Poultry Breeders' Association, to be held at the college next year if sufficient facilities can be made available.

Howard C. Barker, assistant professor in dairy husbandry extension work, has resigned to engage in farming. W. G. Gaessler, assistant chief of the chemical section of the station, has been granted leave of absence until September for graduate work at the Ohio State University, during which time G. P. Plaisance will act as assistant chief. W. H. Johnson, assistant in the soils section, has been granted leave of absence until July for special graduate study at the University of Wisconsin, his work to be carried on by Knute Espe. W. G. Kaiser, assistant in the agricultural engineering section, resigned January 4.

Kansas College and Station.—The estimated attendance at the exercises of farm and home week, February 5 to 10, was 1,800, an increase of 500 over the previous year and representing 96 of the 105 counties of the State. An attempt was made to meet the interests and needs of all classes of visitors by arranging the program in groups under the heads of agriculture, home economics, engineering, boys' and girls' work, cream station operators and butter makers, State associations, and exhibits and contests. The exhibits of the boys' and girls' clubs and the mother and daughter canning clubs, as well as those of the college and station, attracted particular attention.

Dr. F. S. Schoenleber, for 12 years head of the department of veterinary science, has resigned effective March 1. Dr. John Patterson has been appointed instructor in veterinary medicine, beginning February 1. John L. Bayles, assistant in agronomy at the Garden City substation, has resigned to accept a position in the agricultural department of the St. Louis and San Francisco Railroad Co.

Michigan College and Station.—According to a note in the *M. A. C. Record*, the botanical courses for students in agriculture are to be reorganized. The freshman work is to remain substantially as at present, but following this there will be three groups of electives. The first of these, known as applied botany, will be designed for students expecting to engage in work closely associated with farm life, and will include studies of economic plants, plant reproduction, general plant physiology, diseases of economic plants and their control,

weeds and weed seeds, and grasses. The second group, designed for students expecting to teach in secondary or normal schools, will include a special teacher's course, taking up the content of a course in botany in such schools, the method of approach, equipment of the laboratory, source of material, etc. The three groups will comprise electives in technical lines, including advanced plant physiology, mycology, plant pathology and its methods, plant nutrition, plant physics, technique, cytology, and heredity.

More work is also being required in the college in English composition, and additional college credit for the subject is being allowed.

B. A. Knowles, a 1915 graduate, has been appointed instructor in poultry, effective February 3, vice W. H. Tully resigned. W. N. Clark has resigned as instructor in animal husbandry, effective March 10, to become manager of a dairy farm near Chicago. P. B. Wiltberger, instructor in entomology in the University of Maine, has been appointed instructor in entomology and assistant in the station, vice G. C. Woodin.

Minnesota University.—The first annual short course for agricultural editors was held at the college of agriculture beginning February 13, with an attendance of about 150.

Nebraska University and Station.—The attendance at the annual farmer's week is reported to have approximated 1,500. The new dairy husbandry building was dedicated during the week. The principal addresses were by President R. A. Pearson of the Iowa College, who was given the honorary degree of doctor of agriculture, and J. H. Frandsen, who spoke on The New Dairy Building and the Field of Dairy Husbandry.

T. W. Nicolet, assistant professor of landscape architecture, has resigned to become instructor in horticulture at the University of Illinois in connection with courses in design and plant materials in the division of landscape engineering. J. A. Ratcliff has resigned as assistant professor of experimental agronomy, effective April 1, to engage in farming in Oklahoma.

North Carolina College and Station.—The inauguration of President Wallace C. Riddick took place February 22. The principal addresses were by Dr. H. S. Drinker, Hon. Herbert Quick of the Federal Farm Loan Board, former President D. H. Hill, and President Riddick.

Plans are under way to give the seven test farms in the State the status of substations, thereby emphasizing the experimental features rather than demonstrational work in general farming. Many of the station activities with crops, animals, etc., are already carried on at these farms, and it is hoped to arrange for additional funds and equipment for their development. The Pender substation at Willard is to be devoted especially to work with truck crops, the Buncombe substation at Swannanoa is to specialize in small grain and orchard crops, and the Winona substation is to study the handling of muck soils.

R. G. Hill and S. C. Clapp, assistant horticulturist and assistant entomologist respectively, at the main station, have been transferred as assistant directors in charge of the Pender and Buncombe substations, and H. Barker has been appointed assistant director in charge of the Winona substation.

J. E. Moses, county agent in Escambia County, Alabama, has been appointed pig club agent in the extension service.

Ohio State University.—The enrollment for farmer's week exceeded 4,000. Farmers' associations numbering 16 met during this period.

Pennsylvania College.—Nickolas Schmitz, agronomist at the Maryland Station, has been appointed professor of agronomy extension beginning February 17, and Miss Martha S. Pittman, instructor in home economics extension beginning February 12.

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VOL. 36. ABSTRACT NUMBER. No. 6.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The arsenates of lead.—II, Equilibrium in the system PbO, As_2O_5, H_2O, C. C. McDONNELL and C. M. SMITH (*Jour. Amer. Chem. Soc., 38 (1916), No. 11, pp. 2366–2369, fig. 1*).—Continuing the study previously noted (E. S. R., 36, p. 313), it has been shown that the action of dilute ammonia on di-lead arsenate proceeds as follows: "Transposition to tri-lead orthoarsenate, $Pb_3(AsO_4)_2$, the supernatant solution remaining constant at the $(NH_4)_2HAsO_4$ stage until transformation is complete. Formation of solid solutions ranging from tri-lead arsenate to a basic arsenate, beyond which no further change occurs."

Yeast protein, C. NEUBERG (*Wchnschr. Brau., 32 (1915), No. 38, pp. 317, 319, 320*).—The author has isolated several samples of protein from yeast by heat coagulation of an aqueous extract of the dry material. An average sample was found to contain nitrogen 13.02 per cent, sulphur 0.92, and phosphorus 0.59.

The examination of the pure protein material showed the presence of alanin and tryptophan in the protein molecule, acids not reported by earlier investigators. The presence of the alanin suggested it as the source of acetaldehyde encountered in yeast fermentation, and this was verified by experiments carried out with the pure material.

The organic phosphoric acid of starch, J. H. NORTHROP (*Diss., Columbia Univ., 1915, pp. 22*).—This material has been essentially noted from another source (E. S. R., 34, p. 710).

Investigation on the occurrence of chitin and cellulose in bacteria, C. VAN WISSELINGH (*Pharm. Weekbl., 53 (1915), Nos. 33, pp. 1069–1078; 34 pp. 1102–1107*).—From the results obtained it is concluded that chitin is not invariably present in bacteria, but often totally absent from the cell-wall material of the micro-organisms. The usual tests for the detection of chitin are deemed unsatisfactory.

The presence of cellulose was determined in *Bacterium xylinum*, but it is not considered to occur so commonly as indicated by many investigators.

The poisonous principle of poison oak (Rhus diversiloba), J. B. McNAIR (*Jour. Amer. Chem. Soc., 38 (1916), No. 7, pp. 1417–1421*).—The results of the investigation reported are summarized as follows:

The poisonous principle of poison oak (*R. diversiloba*) is not a glucosid of rhamnose, fisetin, and gallic acid. Syme's[1] work from which he concludes that the poison of poison ivy (*R. toxicodendron*) is a glucosid of fisetin, rhamnose,

[1] Some constituents of the poison ivy plant (*Rhus toxicodendron*). Diss., Johns Hopkins Univ., 1906, pp. 37; Amer. Chem. Jour., 36 (1906), No. 3, pp. 301–321.

and gallic acid should be repeated, because (1) it seems strange that two plants so closely related botanically should have such widely different poisons chemically; (2) all three of the so-called constituents of the poison are found in two nonpoisonous species of Rhus; (3) the natural glucosid of fisetin, rhamnose, and gallic acid is nontoxic; and (4) there is not sufficient evidence that the poisonous substance which Syme attempted to decompose was not a complex and containing a poisonous body in addition to one or more nontoxic glucosids.

On the constituents of poison ivy (Rhus toxicodendron), S. F. ACREE (*Jour. Amer. Chem. Soc., 38 (1916), No. 7, pp. 1421–1425*).—The author indicates and discusses the reasons for the variation in the results obtained by Syme and those reported in the above abstract. The botanical difference between the two plants investigated is considered to be the principal reason for the variation of the results.

Lignoceric acid from rotten oak wood, M. X. SULLIVAN (*Jour. Indus. and Engin. Chem., 8 (1916), No. 11, pp. 1027, 1028*).—The author definitely isolated lignoceric acid from rotten oak wood. While no tests for cerebrosids in wood have been made, the presence of cerebronic acid in rotten wood is strongly indicated.

The experimental procedures are described in detail.

Relation between the physical and chemical constants of oils and fats, H. J. BACKER (*Chem. Weekbl., 13 (1916), No. 35, pp. 954–967*).—The author discusses the relations that exist between the various constants and the molecular structure of oils and fats. Oils and fats poor in esters of saturated monocarboxy-acids exhibit a close relationship between the refractive index, density, saponification value, and iodin value. A formula for determining various constants from previously determined constants has been devised and is submitted.

Tabular data of the physical and chemical constants of a number of oils and fats are included.

Storage changes in vegetable and animal oils, H. A. GARDNER (*Jour. Indus. and Engin. Chem., 8 (1916), No. 11, pp. 997, 998*).—Detailed analytical data of the specific gravity, iodin number, saponification number, acid number, and refractive index of a number of oils obtained during various periods of storage, together with data on the effect of sterilization on these constants, are submitted.

The fruit of Smilax rotundifolia, CELIA ROGERS (*Chem. News, 114 (1916), No. 2967, p. 172*).—The fruit of the common greenbrier was examined and found to contain sugar to the extent of 7.5 per cent. The specific gravity of the oil extracted was found to be 0.8585, and it possessed a saponification value of 357.14. The ash was found to comprise 3.06 per cent of the dried fruit, and on analysis yielded the following percentage composition: Silica, 0.08; Fe_2O_3 and Al_2O_3, 17.6; CaO, 0.79; MgO, 0.24; SO_3, 7.92; Mn, 0.76; P_2O_5, 13.38; KCl, 32.38; NaCl, 5.28; and some carbon dioxid and unburned ash.

The nitrogen found was 1.12 per cent, which is equivalent to about 7 per cent of protein in the dried fruit. Citric and tartaric acids were shown to be present, but were not determined quantitatively.

The fruit of Vaccinium corymbosum, C. H. HARRIS and W. D. THRAMS (*Chem. News, 114 (1916), No. 2960, p. 73*).—The following percentage composition of the dried fruit of *V. corymbosum* (blueberry) is reported: Nitrogen, 0.7; oil, 0.93 (specific gravity at 18° C., 0.9, and saponification value 350.96); total sugar (identified as fructose), 41.46; and ash, 0.138.

On analysis the ash was found to have the following percentage composition: SiO_2, 6.33; Al_2O_3, 17.39; Fe_2O_3, 10.5; CaO, 18.11; MgO, 11.48; K_2O, 5.65; Na_2O, 2.26; SO_3, 10.94; P_2O_5, 14.36; MnO, 0.35; and a little undetermined carbon dioxid.

Tartaric and a trace of citric acid were also determined in the aqueous and alcoholic extracts.

The cause of the ureolytic action of soy beans, D. H. WESTER (*Chem. Weekbl., 13 (1916), No. 24, pp. 663–677*).—From the results of the study the author concludes that the ureolytic action of soy beans is not due to bacterial action. The activity of an aqueous glycerin extract was not hindered by antiseptics, except mercuric chlorid and formaldehyde. An aqueous glycerin extract easily passed through a Chamberland-Pasteur candle, the filtrate being practically inactive. This inactivity is not attributed to the removal of any microorganisms, but as probably due to the absorption of the colloidal enzymic material as indicated by the complete loss of the ureolytic action of an extract by treatment with kaolin. The action of sunlight on the extract retarded the enzymic action considerably. Normally the action of the enzym was found to be complete in eight hours at room temperature, in three hours at 30° C., and in two hours at 50°.

On account of the high fat content of the soy beans the author considers it advantageous to remove the oil before preparing the aqueous glycerin extract, as it facilitates later filtration of the extract. In the determination of urease in urine the presence of glucose was found not to interfere up to concentrations of 3 per cent.

An aqueous glycerin extract of soy beans was found to be the most suitable form in which to use the enzym, it retaining its activity for about three months. The enzym in the bean, however, was found to be active after three years.

See also previous notes by Groll (E. S. R., 35, p. 110) and Mom (E. S. R., 35, p. 112).

The separation of oxidase reactions from the catalase reaction, G. B. REED (*Bot. Gaz., 62 (1916), No. 4, pp. 303–310 figs. 3*).—Experiments are reported in which platinized electrodes subjected to either nascent oxygen or hydrogen, as previously described (E. S. R., 35, p. 713), were used.

The results indicate that "factors which have no effect on the peroxidase activity do alter the catalase action. In other words, the peroxidase action is quite independent of the rate of hydrogen peroxid decomposition, and the two reactions may be regarded as quite separate."

Experiments showing that a similar separation of the oxidase from the catalase may occur in the living cell are to be discussed in a subsequent paper.

The relation of oxidase reactions to changes in hydrogen ion concentration, G. B. REED (*Jour. Biol. Chem., 27 (1916), No. 2, pp. 299–302*).—Experiments are reported which indicate that 0.0005–0.007 molar hydrochloric acid is sufficient to prevent the action of certain oxidases. The optimum activity of the oxidases appears to be reached when they are in a medium which is very nearly neutral or slightly alkaline.

Studies in the measurement of the electrical conductivity of solutions at different frequencies.—V. Investigations on the use of the Vreeland oscillator and other sources of current for conductivity measurements. VI. Investigations on bridge methods, resistances, cells, capacities, inductances, phase relations, precision of measurements, and a comparison of the resistances obtained by the use of inductance and capacity bridges. VII. Investigations on the true and apparent resistances, voltage, apparent capacity, size and character of electrodes, ratio of inductance changes to resistance changes, and the relation of induction and capacity to frequency, W. A. TAYLOR and S. F. ACREE (*Jour. Amer. Chem. Soc., 38 (1916), No. 11, pp. 2396–2430, figs. 19*).

The effect of pressure upon the potential of the hydrogen electrode, N. E. LOOMIS and S. F. ACREE (*Jour. Amer. Chem. Soc., 38 (1916), No. 11, pp. 2391–2396*).

Review: The preparation of conductivity water, J. KENDALL (*Jour. Amer. Chem. Soc., 38 (1916), No. 11, pp. 2460–2466*).—The literature on the preparation of conductivity water is reviewed.

By one distillation in the open air of tap water to which a few cubic centimeters of Nessler's solution had been added a water of specific conductivity 0.9×10^{-6} at 25° C. was obtained. By redistillation in silica vessels and collecting the distillate hot, water of specific conductivity $0.2–0.6 \times 10^{-6}$ at 25° was obtained. Such low values, however, were only observed when the distillate was tested at once. On standing, the values rose to $0.8–0.9 \times 10^{-6}$ and remained stationary for some time. The specific conductivity of the water thus obtained is the same as that given by a saturated solution of carbonic acid under atmospheric conditions.

It is indicated that a water obtained as described, to which a proper correction is applied, is as satisfactory in conductivity work as waters distilled by a more elaborate method.

A simple mercury sealed ether still, O. C. SMITH and D. G. MORGAN (*Jour. Indus. and Engin. Chem., 8 (1916), No. 11, p. 1039, fig. 1*).—A convenient arrangement for the distillation of ether, constructed at the Oklahoma Experiment Station, is described and illustrated by drawings.

An electrically heated vacuum desiccator, T. B. ROBERTSON and C. L. A. SCHMIDT (*Jour. Biol. Chem., 27 (1916), No. 2, pp. 429–431, fig. 1*).—A vacuum desiccator, which readily accommodates a 9 in. filter, and its manipulation are described. The desired temperature in the evacuated chamber is maintained by the heated vapor of dichloromethane or some other suitable compound having a boiling point within the range of the temperature desired.

Analysis by machinery, E. SINKINSON (*Chem. News, 114 (1916), No. 2967, pp. 170–172, figs. 3*).—The author describes in detail an electrically operated apparatus for washing precipitates which is considered to be a great time saver. The device is simple in construction, has few moving parts, and can be manipulated with comparatively little attention.

A method for the determination of nitric nitrogen, F. M. SCALES (*Jour. Biol. Chem., 27 (1916), No. 2, pp. 327–337, fig. 1*).—A new method for the determination of nitric nitrogen in which a zinc-copper couple is used is described in detail. The couple used will reduce a nitrate solution at the boiling point, the reduction thus proceeding during the distillation. Soil solutions high in organic matter yield accurate results if clarified with alumina cream. Owing to the very slight alkalinity of the reducing solution unstable organic compounds are not destroyed in the procedure.

Experimental data indicating the accuracy of the method are submitted. A simple apparatus which yields excellent results with the method has been devised and is described.

The efficiency of the aeration method for distilling ammonia; in answer to certain criticisms, P. A. KOBER (*Jour. Amer. Chem. Soc., 38 (1916), No. 11, pp. 2568–2572*).—Contrary to the results reported by Falk and Sugiura (E. S. R., 35, p. 110) and others the author maintains that the distillation of ammonia by aeration yields accurate results. To insure accurate results, however, it is necessary to use a sufficient volume of air, as high a column of liquid with as low a volume as is convenient, and an adequate excess of a saturated solution of pure sodium hydroxid. Impure alkali containing or producing sulphite introduces an error. Potassium hydroxid should not be used because the difficultly soluble potassium sulphate which separates may carry down ammonia by occlusion or as a double salt.

It is indicated that the complete removal of ammonia should be tested with Nessler's solution, and that the aeration should be run slowly or at half speed for the first minute or two.

The separation of lithium from the other alkali metals, S. PALKIN (*Jour. Amer. Chem. Soc., 38 (1916), No. 11, pp. 2326–2332*).—After some preliminary experimentation the author devised a modified procedure, the essentials of which are as follows:

The dried mixed chlorids are dissolved in a definite minimum amount of water, acidified with hydrochloric acid, and the major portion of the sodium and potassium chlorids precipitated by the addition of absolute alcohol followed by ether. The precipitated chlorids are filtered, the filtrate evaporated, the residue taken up in absolute alcohol containing a drop of hydrochloric acid, and the residual amount of sodium and potassium chlorids, which is usually very small, is completely precipitated by the addition of ether. These chlorids are then filtered through the same crucible as used for the first precipitate and the residue washed with ether-alcohol mixture. The ether-alcohol solution of lithium is evaporated on the steam bath, the residue taken up with a little water, and a slight excess of sulphuric acid added. The solution is then transferred to a weighed porcelain or platinum dish, evaporated to dryness, and the residue gently ignited.

The following optional method is also described:

The ether-alcohol solution of the lithium is evaporated to dryness in the steam bath and finally dried in an oven at 110° C. for from 15 to 20 minutes. The residue is taken up in from 5 to 10 cc. of alcohol, warmed if necessary, and then diluted with about 50 cc. of water. If a slight sediment remains the liquid is filtered through a Gooch crucible and washed with water, a few drops of phenolphthalein are added to the filtrate, and the liquid titrated with tenth-normal alkali. The chlorids are precipitated as the silver salt and from the weight of the latter is subtracted the amount corresponding to the hydrochloric acid determined in the titration.

Method of extraction as affecting the determination of phosphoric acid in soils, H. HALE and W. L. HARTLEY (*Jour. Indus. and Engin. Chem., 8 (1916), No. 11, pp. 1028, 1029*).—Analytical data submitted show that the 2-hour digestion with twice-normal nitric acid, as described by Brauer (E. S. R., 33, p. 110), extracts as much phosphoric acid as the official 10-hour digestion with hydrochloric acid of specific gravity 1.115 (E. S. R., 20, p. 512).

Investigation of methods for the determination of the soil reaction, H. R. CHRISTENSEN (*Tidsskr. Planteavl, 23 (1916), No. 1, pp. 1–83, figs. 4*).—Various qualitative and quantitative methods for determining the reaction of soils have been investigated.

The results indicate that a distinction between the true acidity and the base absorption area of the soil must be made. The method of Hopkins, given in Bulletin 73 of the Division of Chemistry (E. S. R., 14, p. 1045), and that of Daikuhara (E. S. R., 31, p. 618), were found to yield reliable results in the determination of soil acidity. The procedure of Baumann and Gully (E. S. R., 19, p. 1008) was found to yield more accurate results than that of Tacke and Süchting (E. S. R., 19, p. 1009).

No free acids were found in sphagnum turf. The use of litmus paper for the qualitative determination of soil acidity is deemed unreliable.

The difficulty of determining the true acidity of a calcareous soil is indicated and briefly discussed.

A bibliography of 33 references is included.

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The determination of volatile fatty acids according to the method of Duclaux, A. Voitkevich (A. Wojtkiewicz) (*Viestnik Bakt. Agron. Sta. V. K. Ferrein, No. 21 (1914), pp. 180–188*).—The method is described in detail, and analytical data obtained by its application to a mixture of acetic, propionic, and butyric acids submitted.

In a comparative study of the method and the distillation of pure acids results not differing more than 5 per cent from each other were obtained. The variation is attributed to differences in the conditions of the distillations. The method is deemed to yield accurate and trustworthy results.

Estimation of sugar in meat products, particularly extracts, W. B. Smith (*Jour. Indus. and Engin. Chem., 8 (1916), No. 11, pp. 1024–1027*).—Slightly modified methods in which mercuric acetate and picric acid are used as protein precipitants are outlined.

The experimental data submitted show that the clarification of meat extract solutions for the estimation of sugar by Fehling's solution is best accomplished by using an excess of picric and phosphotungstic acids, followed by a very small quantity of hydrochloric acid. With the proper precautions reducing sugar may be determined within 0.1 or 0.2 per cent in the presence of sucrose. The total reducing sugar may be determined within 0.1 per cent.

The determination and distribution of moisture in bread, Hannah L. Wessling (*Jour. Indus. and Engin. Chem., 8 (1916), No. 11, pp. 1021, 1022, figs. 2*).—For the determination of moisture in bread the author uses one-half or one-fourth of a loaf, depending upon the character of the crust, and then proceeds as follows:

A suitable portion of the bread is weighed as quickly as possible in a tared dish on a torsion balance, and then carefully heated at a temperature not exceeding 60° C. until practically dry. The dry bread is allowed to stand exposed at room temperature for a few hours in order that its moisture content may come into equilibrium with that of the air, and the loss in moisture to this point is then determined. The air-dried sample is immediately ground to a fine meal and the moisture determined in a 2-gm. sample in the vacuum oven at the temperature of boiling water. From the percentage of moisture obtained in this subsample the total percentage of moisture in the bread is calculated by adding this to the amount lost on heating at 60°. This procedure is practically the same as that previously described.[1]

The results obtained indicate that there is no appreciable difference in moisture content in slices of bread taken at a reasonable distance from the end of the loaf, or in the crumb of any individual slice taken at a reasonable distance from the crust. A great difference, however, was observed between the moisture obtained in the whole bread (as determined on one-half or one-fourth of a loaf) and that in either the crust or crumb taken separately or in one entire slice. In reporting the moisture content of bread it is necessary, therefore, to state what portion of the bread was used as well as how the moisture was determined.

Microscopical examination of chocolates and cocoas.—Determination of shell material in seeds, E. Collin and L. Gobert (*Ann. Falsif., 9 (1916), No. 92-93, pp. 191–202, figs. 8*).—The authors discuss the materials present in chocolate and cocoa which might be considered as adulterants and outline in detail a procedure for microscopical examination. Formulas for calculating the quantity of such foreign material are submitted, together with analytical data obtained from the examination of six samples of chocolate and seven of cocoa. Since the presence of such material can hardly be avoided or prevented in the finished product, it is suggested that in order to secure uniformity the

[1] Arb. K. Gsndhtsamt., 48 (1915), No. 4, pp. 605, 606.

quantity of extraneous material should be controlled by a simple method of examination.

The determination of gum in gum sirups, E. LUCE (*Ann. Falsif.*, *9* (*1916*), *No. 92–93, pp. 227–231*).—The author briefly describes and comments on the methods of Roussin, Bellier (E. S. R., 25, p. 109), and Rocques and Sellier (E. S. R., 28, p. 206). Analytical results obtained show that either the procedure of Rocques and Sellier or that of Bellier is of practical value, the former being slightly the more accurate. The presence of dextrin causes high results. This, however, is a valuable indication of adulteration and a cause for the rejection of the material as nonofficial.

The polariscopic examination of gum sirups before and after inversion is deemed to be an excellent and accurate procedure.

A new method for the determination of vanillin in vanilla extract, A. W. DOX and G. P. PLAISANCE (*Amer. Jour. Pharm.*, *88* (*1916*), *No. 11, pp. 481–484*).—The authors at the Iowa Experiment Station describe the following gravimetric procedure based on the reaction of thiobarbituric acid and certain aromatic aldehydes previously noted (E. S. R., 36, p. 318) for the determination of vanillin:

Twenty-five cc. of the extract is dealcoholized in the usual manner, transferred to a 50-cc. standard sugar flask, and filled to the mark with lead acetate solution. After standing for several hours at about 37° C. the contents of the flask are filtered through a dry filter, 40 cc. of this filtrate is transferred to another 50-cc. flask, and sufficient hydrochloric acid added to bring the volume to 50 cc. and the acidity to 12 per cent. After standing for a few minutes the lead chlorid is filtered off and 40 cc. of the filtrate taken for the determination. Thiobarbituric acid in 12 per cent hydrochloric-acid solution is added, and an orange-colored precipitate results. The precipitate is allowed to stand overnight, filtered on a Gooch crucible, washed with hydrochloric acid, and dried at 98°. A simple correction for slight solubility is necessary. Analytical data submitted indicate the accuracy of the procedure.

The method is not applicable, however, to extracts which contain caramel, since the caramel contains furfural derivatives which react with thiobarbituric acid. When caramel is present the filtrate after clarification is brown instead of straw colored. A very delicate test was devised by the authors in which after clarifying and removing the excess of lead as chlorid, phloroglucinol is added. In the presence of caramel a brown precipitate is formed, and in its absence the vanillin gives a delicate rose pink color or slight pink precipitate.

The use of amyl alcohol in Gerber's method for the determination of fat in milk, ORLA-JENSEN (*Mælkeritid.*, *29* (*1916*), *No. 7, pp. 104–106*).—From a comparison of the Babcock and Gerber methods it is indicated that the latter in general yields the higher results, the error increasing with the percentage of fat in the milk. The necessity of using amyl alcohol of standard purity is emphasized.

The biological method for judging the freshness of milk according to Parashchuk (Paraschtschuk), P. KALANTAROV (*Viestnik Bakt. Agron. Sta. V. K. Ferrein, No. 21* (*1914*), *pp. 84–98*).—The author investigated the method previously noted (E. S. R., 31, p. 506), and found that all the strains of lactic acid bacteria will grow well in the three grades of milk, very fresh, fresh, and old. No evidence of any difference in action in the sense indicated by the originator of the method was noted.

Other experiments were carried on with various combinations of the microorganisms recommended in the original procedure, with the same negative results.

It is concluded that the method is absolutely impracticable and unreliable.

A polariscopic determination of sugar in "condensed milk," R. O. BROOKS (*Jour. Indus. and Engin. Chem., 8 (1916), No. 11, 1022–1024*).—The following modified procedure is described:

Fifty gm. of the well-mixed sample is diluted with water to exactly 100 cc. and carefully shaken until completely dissolved. Exactly 26 cc. (13 gm.) is pipetted into a beaker, diluted with water to about 40 cc., and Fehling's solution added drop by drop with constant stirring until the proteins and fat are precipitated. Usually about 1.5 cc. is sufficient. The mixture is then filtered and the precipitate washed with water until the filtrate measures exactly 100 cc. The filtrate is thoroughly mixed and a direct reading taken in a 200 mm. tube of the polariscope at a temperature between 20 and 30° C. To exactly 50 cc. of the filtrate 5 cc. concentrated hydrochloric acid is added, mixed, and allowed to stand overnight at a temperature between 20 and 30°. The acid is exactly neutralized with strong alkali, using phenolphthalein, and again very slightly acidified with hydrochloric acid. It is then made up to 100 cc., filtered, and the invert reading taken in a 200 mm. tube, as above. The direct reading is multiplied by 2 and the invert reading by 4, and the sucrose calculated by Clerget's formula, using the factor 141.7 as follows:

$$\text{Sucrose}=\frac{100\ (\text{Direct reading}-\text{Invert reading})}{141.7-\frac{\text{Temp.}}{2}}$$

The procedure described is considered to be rapid and to yield accurate results.

A study of proteins in urine and a comparison of gravimetric and nephelometric methods for their estimation, J. T. W. MARSHALL, H. W. BANKS, 3RD, and S. S. GRAVES (*Arch. Int. Med., 18 (1916), No. 2, pp. 250–262*).—A nephelometric method, using egg albumin as a standard for the determination of protein in urine, and a formulative expression of the relation between the light and concentration are submitted.

It is concluded that "the nephelometric method is satisfactory for clinical purposes, and that the results are in fair agreement with those obtained by the gravimetric method. For urines of low protein concentration the method is no doubt more accurate than the gravimetric. . . .

"The nitrogen content of the protein recovered has been found to be lower than the generally accepted values in the case of urine protein."

An accurate aeration method for the determination of alcohol in fermentation mixtures, A. W. DOX and A. R. LAMB (*Jour. Amer. Chem. Soc., 38 (1916), No. 11, pp. 2561–2568*).—The determination of alcohol by oxidation with sulphuric acid and dichromate solution has been carefully studied. The best results were obtained when the alcohol was determined by distillation and titration of the acetic acid formed.

A procedure in which the solution is saturated with ammonium sulphate and the alcohol carried over into concentrated sulphuric acid by a current of air is described. The alcoholic sulphuric acid solution is then mixed with a solution of potassium dichromate, and the acetic acid distilled off at once. The method has been used for the determination of alcohol in various kinds of silage at the Iowa Experiment Station with very satisfactory results.

The precautions necessary in the presence of interfering substances are discussed.

The distillation of cane sugar at the distillery of Oisemont (Somme), É. SAILLARD (*Compt. Rend. Acad. Agr. France, 2 (1916), No. 24, pp. 676–681*).—These pages briefly record the results of the use of molasses, beets, and apples

as sources of alcohol; the preparation of fermentation mixtures; and yields of the finished product. A list of the apparatus used in the work is included.

Home and farm canning, W. V. CRUESS (*California Sta. Circ. 158* (*1916*), *pp. 31, figs. 10*).—This discusses the subject under the general topics of causes of spoiling; various methods of sterilization; general principles of home canning; and operations, materials, and equipment necessary in canning. Special directions for canning various fruits and vegetables are given in some detail.

The theory and practice of the use of pure yeast in the preparation of fruit wines, S. A. KOROLEV (*Viestnik Bakt. Agron. Sta. V. K. Ferrein, No. 21* (*1914*), *pp. 99–152*).—The literature on the subject is reviewed in some detail and a bibliography of 41 references included.

Note on the Burma myrobalans or "panga" fruits as a tanning material, PURAN SINGH ([*Indian*] *Forest Bul. 32* (*1916*), *pp. 5*).—Experimental data submitted show that Burma myrobalans are inferior to the Indian myrobalans in tanning strength, in color, and in containing an excess of nontannin material. It is indicated, however, that they can be used satisfactorily for tanning, especially when mixed with other materials similar to the Indian myrobalans. A procedure for the preparation of Burma myrobalans for the trade is outlined.

The conservation of pork, with special reference to preservation by boxing and tubbing, E. KALLERT and R. STANDFUSS (*Zent. Einkaufsgesell. Beschränkt. Haftung, Abhandl. No. 4* (*1916*), *Orig., pp. 96, figs. 2*).—This pamphlet discusses the preservation of pork by salting, pickling, and smoking, and various experiences in conserving by boxing and tubbing. An appendix containing brief directions for the various procedures of conserving pork, rules to be conformed with in the conservation, and certain control measures in the inspection of such products is included.

Conservation of fish by freezing, R. PLANK, E. EHRENBAUM, and K. REUTER (*Zent. Einkaufsgesell. Beschränkt. Haftung, Abhandl. No. 5* (*1916*), *Orig., pp. 248, pls. 9, figs. 37*).—This publication is divided into two parts, a comparative investigation of different procedures of freezing, and histological and taste changes in frozen fish.

In general it is concluded that the rapid freezing in salt solution is to be highly recommended. Direct freezing in ice was also found to yield excellent results for certain fish. Slow freezing in cold air, however, was not found to be satisfactory. With proper care during the preserving period, there is only a very slight change in the taste of the fish. Thawing by soaking in cold water was found to be the most economical and satisfactory procedure.

A method for determining the strength of paper when wet, E. O. REED (*Jour. Indus. and Engin. Chem., 8* (*1916*), *No. 11, pp. 1003, 1004*).

METEOROLOGY.

The weather map: An introduction to modern meteorology, N. SHAW (*London: Meteorological Office, 1916, pp. 94, pls. 8, figs. 20; rev. in Nature* [*London*], *98* (*1916*), *No. 2459, pp. 286, 287*).—This is a short elementary treatise which appears to be designed primarily for the benefit of those who are making use of meteorology in the present war, but deals with the subject in such a way as to be of interest to others. The lessons of the weather maps are especially well presented.

Highest and lowest temperatures of 1916 (*U. S. Dept. Agr., Nat. Weather and Crop Bul. 32* (*1916*), *p. 2, pl. 1*).—Two charts showing the extremes of temperatures during the year are given and briefly explained.

As compared with 1915 "the temperatures were considerably lower in 1916 in Montana, Wyoming, Colorado, Kansas, and eastern Washington. The

isotherms of 10 and 20° were farther south in the cotton belt in 1916 than in 1915, as were also the lines of 32 and 40° in Florida."

Frosts of 1916 (*U. S. Dept. Agr., Nat. Weather and Crop Bul. 31 (1916), p. 2, pl. 1*).—Two charts showing dates of occurrence of the last killing frost in spring and the first in autumn are given and briefly discussed.

The last killing frost in spring occurred at an earlier date than the average in Texas, eastern Arkansas, southern Tennessee, the upper Mississippi Valley, States immediately north of the Ohio River, and the Middle and North Atlantic States. It was later than usual in South Carolina, Georgia, and northeastern Florida. "In most portions of the Atlantic States north of Georgia and generally in the States around Lake Michigan killing frosts during the present autumn occurred at a later date than the average; but in most of the central Gulf States and Texas, and generally in the Great Valley of California, killing frost occurred somewhat earlier than usual."

Report of the meteorological service [of Canada], R. F. STUPART (*Proc. and Trans. Roy. Soc. Canada, 3. ser., 10 (1916), App. C, pp. LXXXIII–CI*).—This is a summary account of the work of the service in the physics branch, agricultural meteorology, terrestrial magnetism, and seismology during 1916, with a record of phenological observations in the different Provinces of Canada during 1915.

The meteorological office of Argentina, G. G. DAVIS (*Min. Agr. Argentina, Mem. Cong. Nac., 1914–15 pp. 251–324*).—This article briefly reviews the history of this office, which is a bureau of the ministry of agriculture of Argentina, and gives its status at the end of 1915, special attention being given to the subject of hydrometric and magnetic observations. It contains a complete list of stations and observers, showing that at the end of 1915 there were 42 stations of the first class, 156 of the second, 12 of the third, and 1,930 of the fourth, making a total of 2,140 stations of all classes.

The climate of France, G. BIGOURDAN (*Le Climat de la France. Paris: Gauthier-Villars & Co., 1916, pp. 135, figs. 61; rev. in Rev. Gén. Sci., 27 (1916), No. 22, pp. 663, 664*).—This book, based upon the work of the Central Meteorological Bureau of France, shows the mean values and daily, monthly, and annual variations, as well as the extremes of the principal meteorological elements—temperature, pressure, and wind—for each place in France where observations have been taken.

The oscillation of climate in southeast Russia, A. TOL'SKIĬ (A. TOLSKY) (*Zhur. Opytn. Agron. (Jour. Agr. Expt.) 17 (1916), No. 4, pp. 255–277, figs. 2*).—A certain periodicity of dry and hot and moist and temperate seasons in this region during the nineteenth century is noted and discussed.

Influence of the weather on the use by plants of fertilizers, H. R. CHRISTENSEN (*Tidsskr. Planteavl, 23 (1916), No. 2, pp. 251–288*).—Experiments showed that the meteorological conditions of the year influenced greatly the absorption of fertilizers by plants. The absorption of mineral fertilizers, such as sodium nitrate alone or in addition to manure, was less the more favorable the meteorological conditions were for plant growth, indicating that in years when the weather conditions were such as to increase the absorption of the nutritive substances of manure, the plants needed less the nutritive substances contained in the mineral fertilizers.

SOILS—FERTILIZERS.

Measurements of soil fertility, W. H. JORDAN (*New York State Sta. Bul. 424 (1916), pp. 389–412*).—This bulletin reports the results of chemical analyses and vegetation tests of nine unlike soils brought to the station from different parts

of the State for the purpose of studying the relation of different methods of chemical examination to crop-producing power.

"The soils were submitted to chemical examination by different methods: (1) Complete analysis; (2) a determination of the material soluble in hydrochloric acid of the specific gravity of 1.115 by the A. O. A. C. method; (3) a determination of the materials rendered soluble by continued leaching for 10 days with water, N/200 HCl and N/25 HCl; [and] (4) a determination of the soluble material obtained by shaking five hours with water, N/200 HCl, and N/25 HCl.

"These soils showed by the vegetation tests greatly unlike crop-producing capacity, the dry matter produced varying in two years from 161.5 gm. per box to 9.4 gm. per box. By no one of the methods of chemical examination was there established any relation between the amounts of nitrogen, phosphoric acid, and potash, either total or soluble, and crop-producing capacity. There appeared to be some relation between the total soluble matter in the soil and productiveness, to the extent that the two soils giving a very low yield of barley showed greatly less solubility than did the others. This relation, however, was not consistent throughout." The general conclusion reached was that the laboratory methods so far devised are not capable of measuring the fertility of soils.

Concerning tillage, R. T. BURDICK (*Vermont Sta. Bul. 198 (1916), pp. 50–83, figs. 19*).—This article deals with the principles and practice of tillage. Twenty-three references to literature cited are included.

Soil survey of Clay County, Alabama, A. E. TAYLOR, E. S. VANATTA, N. E. BELL, and J. L. ANDRESS (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 41, fig. 1, map 1*).—This survey, made in cooperation with the State of Alabama, and issued December 30, 1916, deals with the soils of an area of 385,280 acres in the Piedmont Plateau and Appalachian Mountain provinces in east-central Alabama. "The topography is undulating to mountainous, and consists largely of parallel ridges and valleys, with broad rolling areas. . . . There are no large streams, but all parts of the county are reached by drainage ways. . . .

"About 96 per cent of the soil is residual in origin, about 3 per cent alluvial, and about 1 per cent colluvial. The loam and stony loam types of soil predominate." Including rough stony land, 23 soil types of 12 series are mapped, of which the Louisa loam and stony loam and the Talladega and Louisa slate loams cover 18, 17, 11.7, and 8.3 per cent of the area, respectively. The Louisa series is the most extensive, covering about 56 per cent of the area.

Soil survey of Clinton County, New York, E. T. MAXON and W. R. CONE (*N. Y. State Col. Agr., Cornell Univ. Ext. Bul. 3 (1916), pp. 30–65, pl. 1, fig. 1*).—This survey has been previously noted from another source (E. S. R., 35, p. 18).

The soils of Cuba, J. T. CRAWLEY (*Estac. Expt. Agron. Cuba Bol. 28 (1916), pp. 86, pls. 19*).—This bulletin discusses in some detail the more important physical, chemical, and biological factors of soils, and reports the results of chemical analyses of about 305 samples of typical Cuban soils and chemical analyses of about 28 samples of Cuban waters.

Microbiological investigation of the soil in connection with crop yields, A. VOITKEVICH (A. WOJTKIEWICZ) (*Viestnik Bakt. Agron. Sta. V. K. Ferreĭn, No. 21 (1914), pp. 153–179*).—Studies in all four seasons of the year of bacterial numbers, nitrogen-fixing power, nitrification, denitrification, putrefaction, urea decomposition, and carbon dioxid production in certain fallow soils and soils planted to winter crops, root crops, clover, and oats are reported.

The bacterial numbers were greatest in the spring and were only slightly higher in summer than in winter. No striking differences in bacterial numbers

with the time of year were noted. The nitrogen-fixing power was lowest in winter and gradually increased through the spring and summer to a maximum in the fall.

On the basis of these results the author judges these soils to be entirely unsatisfactory with reference to productivity.

It was further found that the greatest bacterial numbers and nitrogen fixation occurred in a soil growing root crops, while the fallow soil stood nearly the last in both. Conclusions based on these results are considered unsafe.

The organic matter of the soil.—I, Some data on humus, humus carbon, and humus nitrogen, R. A. Gortner (*Soil Sci., 2 (1916), No. 5, pp. 395–442, pls. 2, figs. 17*).—Experiments conducted at the Minnesota Experiment Station are reported in which "eight mineral soils, three peats, one muck, and five samples of unchanged vegetable materials were selected and analyzed for total carbon and total nitrogen; for carbon and 'humus' soluble in 4 per cent NH_4OH both before and after leaching the substances with 1 per cent HCl; for carbon and nitrogen soluble in 4 per cent NaOH both before and after leaching the material with 1 per cent HCl; for carbon and nitrogen extracted by 4 per cent NaOH from the residue remaining after the soil or vegetable materials which, without previous treatment, had been extracted with 4 per cent NaOH and subsequently leached with acid; for carbon and nitrogen extracted by the addition of water to the residue remaining from the preceding extraction; and for nitrogen in the 1 per cent HCl extract. Colorimetric measurements were also made on the various solutions."

The results of a comparison of the data obtained are taken to indicate that "the 'humus' extract of soils and peats is not a typical soil product, formed in the soil by the action of bacteria and fungi, for very similar extracts can be obtained from unchanged vegetable materials. 'Humus' does not consist entirely of a black compound, or compounds, but it also contains a large proportion of almost colorless substances, the presence of which is normally masked by the black color. A 4 per cent solution of sodium hydroxid does not extract either the same substances or the same quantity of substances as does a 4 per cent solution of ammonium hydroxid. From a given soil, after leaching with 1 per cent HCl, ammonium hydroxid will extract less carbon and at the same time more color than will a sodium hydroxid solution. In general the forms of soil nitrogen appear to be quite similar in solubility to those forms occurring in unchanged vegetable materials, the only noteworthy difference being that vegetable materials contain a very considerable amount of nitrogen soluble in 1 per cent HCl while soils contain only a small quantity, and the soils contain an appreciable amount of nitrogen quite insoluble in 4 per cent NaOH, in decided contrast to the unchanged vegetable materials."

All the mineral soils and the one calcareous peat tested contained a soil pigment which was absent from the unchanged vegetable materials or the acid peats, was intensely black, and contained only a relatively small proportion of the soil nitrogen.

From the results obtained, it is considered extremely doubtful if a specific "humification" of plant materials takes place in the soil.

It is concluded that "the common practice of comparing 'humus nitrogen,' determined in a 4 per cent NaOH extract, with 'humus,' obtained by 4 per cent NH_4OH, can give only meaningless results. . . . A determination of the 'humus' as ordinarily carried out appears to be wholly without scientific justification. The European method of reporting 'humus' by making a determination of total organic carbon appears to be far preferable."

Thirty-one references to literature bearing on the subject are cited.

Chemical, bacteriological, and agricultural investigations on an experimental cultivated soil, K. Diem (*Meded. Deli-Proefstat. Medan, 9 (1916), No. 5, pp. 143–176, pls. 7*).—Experiments on the influence of methods of cultivation, of physical, mechanical, and chemical properties of tobacco soils, and of mixing the ashes of weeds with soils on the height and green weight of tobacco plants are reported.

No relation was found to exist between the green weight or height of plant and the soil properties. The intermixing of considerable amounts of weed ashes with the soil also had no appreciable influence on the stand of tobacco.

Influence of pine resin and tannin on the nitrogen economy and on the physical properties of the soil, A. Koch and Alice Oelsner (*Centbl. Bakt. [etc.], 2. Abt., 45 (1916), No. 1–5, pp. 107–118; abs. in Jour. Chem. Soc. [London], 110 (1916), No. 644, I, p. 454*).—The results of experiments on the influence of colophony on the biological transformation of nitrates are taken to indicate that pine resin in soils produces a source of energy for nitrate-reducing soil bacteria. This is thought to explain in part why soils containing resin contain less nitrate than soils containing no resin. It is further considered possible that nitrification in soils is hindered by the presence of resin constituents dissolved by alkali salts.

In experiments on the influence of tannin on the biological transformation of soil nitrates, it was found that tannin is readily assimilated by mold fungi. The results are taken to indicate that the increased growth of fungi gives rise to a temporary loss of nitrogen present as nitrate and ammonia, thus explaining why soils containing tannin contain only small amounts of nitrate. With reference to the production from tannin of poisonous substances inhibiting nitrification it was found that no oxalic acid was produced from tannin by *Aspergillus niger*.

The addition of tannin to soils resulted in the production of a dark color not due to iron, and increased the power of retaining water. Large additions of tannin caused the soil to become hard, this being attributed tentatively to the precipitation of colloids.

Influence of moisture on the nitrogen changes in soils, A. E. Traaen (*Centbl. Bakt. [etc.], 2. Abt., 45 (1916), No. 1–5, pp. 119–135; abs. in Chem. Abs., 10 (1916), No. 16, p. 2118*).—Experiments on nitrification, denitrification, and nitrogen fixation showed that nitrogen fixation especially was most active when the soil contained medium amounts of moisture.

On the nature of ammonification and nitrification, K. Miyake (*Soil Sci., 2 (1916), No. 5, pp. 481–492, fig. 1*).—A mathematical analysis, made at the Tohoku Imperial University, Japan, of the processes of ammonification and nitrification in soils as described in experimental work by others is reported. On the basis that the processes of ammonification and nitrification are autocatalytic chemical reactions, it is pointed out that in these processes the maximum increase of ammonia and nitric acid in a unit of time occurs when the total amount of production due to these processes is half completed.

"Increases of ammonia and nitric acid in the processes are in accordance with the formula: $\text{Log}\,\frac{x}{A-x}=K\,(t-t_1)$, where x is the amount of ammonia and nitric acid which has been produced at time t, A is the total amount of ammonia and nitric acid produced during the process, K is a constant and t_1 is the time at which half of the total amount of ammonia and nitric acid is produced."

The gain in nitrogen from the growth of legumes on acid soils, E. B. FRED and E. J. GRAUL (*Wisconsin Sta. Research Bul. 39 (1916), pp. 42, figs. 20*).—This is a progress report of pot and field experiments made to study the growth and nitrogen-fixing power of red clover, alfalfa, and soy beans in acid Colby silt loam and acid Plainfield sand under the influence of liming and inoculation and to study the nitrogen balance in an acid soil before and after growing a leguminous crop.

It was found that inoculation and liming produced striking increases in plant growth, half enough lime to neutralize the soil acidity being sufficient for the production of good crops. "The growth and nitrogen content of alfalfa plants on Colby silt loam soil are greatly increased by inoculation. This influence was most noticeable in the limed series. The benefit of lime alone was much less pronounced than inoculation alone. In the case of soy beans in the same soil, inoculation caused a very marked increase in both yield and quantity of nitrogen. Lime apparently did not have any decided influence on soy beans." In the Plainfield sand an enormous increase of nitrogen in the plant was noted from inoculation, especially after the second cutting.

Clover on Colby silt loam responded only slightly to liming and not at all to inoculation, but on Plainfield sand responded readily to both inoculation and liming. The results obtained from field experiments with alfalfa and soy beans on Colby silt loam agreed in general with those of the pot tests.

Two fundamental facts are brought out, (1) that the characteristic effect of inoculation of alfalfa on acid Colby silt loam and acid Plainfield sand is an increase in plant growth and in the fixation of atmospheric nitrogen, and (2) that small applications of lime on acid soils are more economical than large applications.

Twenty-one references to literature bearing on the subject are appended.

The physiologically acid and alkaline salts and their importance in the explanation of soil sickness, J. H. ABERSON (*Meded. Rijks Hoogere Land, Tuin en Boschbouwsch. [Wageningen], 11 (1916), No. 1–3, pp. 1–128, pls. 10*).—The work of others bearing on the subject is reviewed, and experiments are reported from which the following conclusions are drawn:

The physiologically acid and alkaline salts exert very little influence on soil reaction in the field, although much of the lime is lost from soil by heavy fertilization with ammonium salts, thus causing marked changes in the soil properties. Changes of soil reaction in pot cultures can be considered as representing field conditions in only a very general way. The alkaline or acid reaction of the soil is not the cause of the so-called dry spot sickness (Dürrfleckenheit).

It is stated that the dry spot sickness appears on all soils, but when ammonium sulphate is used the disease has a different appearance than the so-called acid sickness attributed to the slow formation of nitrites. The disease was found to accompany the occurrence of nitrites in soils and *Bacillus nitrosus* was obtained in pure culture. Injurious action took place only where nitrification was slow and insufficient, and treatment producing active nitrification eradicated the trouble.

The vertical distribution of phosphorus in the surface soil of prairies, F. J. ALWAY and C. O. ROST (*Soil Sci., 2 (1916), No. 5, pp. 493–497*).—Determinations of the phosphorus content of each inch section of the surface foot of the soils of 30 virgin fields in six different areas of the Nebraska loess, made at the Minnesota Experiment Station, are reported.

It was found that "prairie loess soils in the surface foot show a steady decrease in phosphorus from the surface inch downward, independent of the

aridity of the climate in which they have formed. The concentration of phosphorus in the surface layers, while it may be attributed to the prairie vegetation, is not dependent upon a corresponding concentration of organic matter, the difference between the first and the twelfth inch being much the greater with the latter." The average phosphorus contents of the soils of the six areas were 0.141, 0.137, 0.147, 0.122, 0.132, 0.145, and 0.137 per cent.

In addition attention is drawn to the importance of considering the relative densities of soils when taking samples for comparisons of the phosphorus content of long cultivated soil with that of virgin prairie or prairie fields.

The mobilization of soil phosporic acid under the influence of bacteria, IV, S. SEVERIN (S. A. SEVERIN) (*Viestnik Bakt. Agron. Sta. V. K. Ferreĭn, No. 21 (1914), pp. 53–83*).—Continuing investigations previously reported (E. S. R., 31, p. 721), experiments with chernozem soil on the influence of the activity of certain soil micro-organisms on the solubility of phosphoric acid, carbon dioxid production, the quantitative variation of nitrate content, total nitrogen, and on bacteral numbers are reported.

In the first series three soil samples were used, one sterile, a second sterilized and inoculated with pure cultures of Azotobacter, and a third sterilized and inoculated with cultures of *Bacterium radicicola* and Azotobacter. The phosphoric acid soluble in acetic acid increased in the inoculated soils from 8 to 14 per cent over that in the sterile soil.

In a second series one soil was sterilized, a second sterilized and inoculated with pure cultures of *B. fluorescens liquefaciens*, and a third sterilized and inoculated with pure cultures of *Bacillus mesentericus vulgatus*. The soluble phosphoric acid decreased about 5.8 per cent in the second soil and increased about 12.9 per cent in the third soil. Carbon dioxid production was about the same in both soils, but the numbers of *Bacterium fluorescens liquefaciens* far exceeded those of *Bacillus mesentericus vulgatus*. Both bacterial types were accompanied by a similar increase in soil nitrogen (about 20.6 mg. in 100 gm. of dry soil) and a slight decrease in nitrate content, the latter being more marked in the case of *Bacterium fluorescens liquefaciens*.

In the third series one soil was allowed to stand two months in its natural state, a second was sterilized, and a third was sterilized and inoculated with pure cultures of *Bacillus mycoides*. The bacterial numbers in the third soil differed but slightly from those in the first soil. Carbon dioxid production was four times as great in the first soil as in the third. *B. mycoides* showed no effect on the soil nitrate content or on the total nitrogen content, while both were decreased in the unsterilized soil. The soluble phosphoric acid decreased about 12.6 per cent in the unsterilized soil and increased about 4.2 per cent in the soil containing *B. mycoides*.

The influence of salts on the bacterial activities of the soil, J. E. GREAVES (*Soil Sci., 2 (1916), No. 5, pp. 443–480, figs. 4*).—Experiments conducted at the Utah Experiment Station on the influence of the chlorid, nitrate, sulphate, and carbonate of sodium, potassium, calcium, magnesium, manganese, and iron on ammonification in a productive sandy loam soil are reported.

It was found that the toxicity of the salts tested as determined by ammonification was controlled largely by the electro-negative ion. As a general rule, to which there were exceptions, the chlorids were the most toxic and nitrates, sulphates, and carbonates followed in the order of decreasing toxicity. The quantity of a salt which could be applied to a soil without decreasing the ammonia formed varied with the salt, and for the soil under investigation the order of decreasing toxicity of the salts was as follows: Calcium chlorid, calcium nitrate, sodium sulphate, potassium sulphate, magnesium nitrate, ferric

sulphate, potassium chlorid, magnesium chlorid, sodium chlorid, manganous chlorid, magnesium sulphate, manganous sulphate, potassium nitrate, ferric chlorid, manganous nitrate, sodium nitrate, magnesium carbonate, calcium sulphate, ferrous carbonate, ferric nitrate, potassium carbonate, sodium carbonate, manganous carbonate, and calcium carbonate. The last two were not toxic in any of the concentrations used. It was not necessarily those compounds which become toxic in the lowest concentrations which were most toxic in higher concentrations, as the toxicity of some salts increased more rapidly than the toxicity of others. It is considered evident that the increased osmotic pressure exerted by the salt added to the soil plays a great part in the retarding of the bacterial activity but that it is not the only factor.

"The common soil 'alkalis,' sodium chlorid, calcium chlorid, sodium sulphate—and the less common one—calcium nitrate, are very toxic to ammonifying organisms, and if present in soil to any great extent will greatly reduce the ammonia produced in such a soil.

"Calcium chlorid, calcium nitrate, potassium chlorid, potassium sulphate, magnesium nitrate, and sodium sulphate failed to increase the ammonia produced in a soil. All of the others, however, in some of the concentrations tested acted as stimulants. The extent of the stimulation and the quantity of salt necessary for maximum stimulation varied with the compound. In the order of increasing efficiency they are magnesium chlorid, manganous chlorid, potassium nitrate, ferric nitrate, magnesium carbonate, calcium sulphate, ferric sulphate, magnesium sulphate, sodium chlorid, sodium nitrate, ferrous carbonate, potassium carbonate, sodium carbonate, manganous carbonate, calcium carbonate, manganous nitrate, ferric chlorid, and manganous sulphate. Those compounds which are most active as stimulants to the higher plants are also most active in stimulating bacteria. . . .

"The quantity of sodium chlorid, calcium chlorid, potassium chlorid, and magnesium chlorid required to reduce the ammonifying powers of the soil to half normal is practically the same as the quantity necessary to reduce the growth of wheat to the same extent. The ammonifying organisms are apparently more resistant to the other compounds tested than are the higher plants."

Fifty-seven references to literature bearing on the subject are cited.

A preliminary report on muck humus as a fertilizer and carrier of beneficial soil bacteria, T. F. MANNS and J. M. GOHEEN (*Delaware Sta. Bul. 115 (1916), pp. 3–40, pls. 13*).—It was found in the studies here reported that muck such as is found in the trucking districts of northern New Jersey, although normally low in beneficial soil bacteria (containing a limited number of clover nodule bacteria only), becomes a very favorable medium for the growth of such bacteria when properly balanced and reinforced, especially with basic substances. Forty different combinations or composts were tested in these studies. Among those giving the best results with nodule-forming bacteria were (1) muck 2,000 lbs., Thomas slag 15 to 50 lbs., carbohydrate 30 to 60 lbs., inoculating soil 25 lbs.; (2) muck 2,000 lbs., potassium carbonate 10 lbs., acid phosphate 50 lbs., calcium carbonate 100 lbs., carbohydrate 30 lbs., inoculating soil 25 lbs.; and (3) muck 2,000 lbs., ash 25 lbs., Thomas slag 25 lbs., calcium carbonate 100 lbs., carbohydrate 30 lbs., inoculating soil 25 lbs.

Satisfactory inoculation of the composts was secured with soil which had been found to give strong inoculation to each of the various groups of legumes. *Azotobacter chroococcum* was readily introduced by using soils from Colorado and North Dakota. The inoculated composts gave strong inoculation to the different groups of legumes when the latter were grown in sterilized sand cultures using the composts at the rate of 2 lbs. per acre of 2,000,000 lbs. Somewhat

stronger inoculation and growth were produced by using the compost at rates of 100 and 500 lbs. per acre. Crude carbohydrates and basic compounds such as ash and Thomas slag proved very efficient in developing nodule-forming as well as nitrogen-fixing and nitrifying organisms, ash being the most active mineral substance in this respect as indicated by crop response. Properly reinforced composts furnished all of the nitrogen required for the growth of rye and millet, being more effective in this respect than applications of cyanamid and guano.

The results reported show that the nodule-forming organisms of alfalfa, red clover, soy beans, and cowpeas may grow well in muck humus having a lime requirement of 5,000 lbs. per acre of 2,000,000 lbs.

Experiments on "humogen" (bacterized peat), J. A. VOELCKER (*Woburn Expt. Sta. Rpt. 1915, pp. 43–48, pl. 1; Jour. Roy. Agr. Soc. England, 76* (*1915*), *pp. 357–362, pl. 1*).—Experiments with oats, peas, and mustard to determine the influence of bacterized peat when added in amounts of 1 part peat to 9 and 19 parts of soil are reported. Sodium nitrate in equivalent amounts with reference to nitrogen content was used for comparison. The following conclusions are drawn:

"Under conditions such as those obtaining in greenhouse cultivation, and where plants can be regularly watered and tended, a good preparation of 'humogen' may produce a very marked increase in the growth of the green parts of plants and in the growing of green crops, but it will show practically no benefit in the production of grain."

Contribution to the knowledge of the nodule bacteria (Bacterium radicicola) in soils, P. KALANTAROV (P. B. KALANTAROW) (*Viestnik Bakt. Agron. Sta. V. K. Ferrein, No. 21* (*1914*), *pp. 21–52*).—The work of others bearing on the subject is briefly reviewed and culture experiments with chernozem and productive loam soils are reported.

It was found that nodule bacteria require for their growth a minimum moisture content of about 30 per cent. The growth of *B. radicicola* increased with greater moisture contents. In general a certain parallelism existed between moisture content of sterilized soil and the number of active nodule bacteria.

A study of the relation of other soil bacteria to *B. radicicola* showed that *Bacillus mycoides* and *Bacterium fluorescens liquefaciens*, neither in soil nor culture media, exerted any appreciable influence on the growth of *Bacterium radicicola*. On the other hand, *Bacillus mesentericus vulgatus* and *B. coli communis* showed a rather strong antagonism toward *Bacterium radicicola*. The injurious influence of these organisms was weaker in soil. Inoculation of nodule bacteria into sterilized and unsterilized soils resulted in a slow, weak growth. A slight change in the physiological properties of the nodule bacteria isolated from the unsterilized soil was observed.

Studies of a number of bacteria isolated directly from soil led to the conclusion that only one of these could be placed with certainty in the *B. radicicola* class.

The movement of nodule bacteria in sterilized soil was not very marked, averaging only about 0.52 cm. per day.

Are spore-forming bacteria of any significance in soil under normal conditions? H. J. CONN (*Jour. Bact., 1* (*1916*), *No. 2, pp. 187–195*).—Experiments made at the New York State Experiment Station with three of the spore-forming bacteria always present in soil (*Bacillus mycoides, B. cereus*, and *B. megatherium*) are reported, which showed that "when soil infusion was heated before plating at a temperature (75–85° C.) high enough to kill the vegetative forms of bacteria, nearly, if not quite, as many colonies of these spore-forming

bacteria developed as when it was plated unheated. . . . This suggests that these bacteria occur in normal soil as spores rather than in a vegetative state. No increase in the total number of these organisms nor decrease in the number of their spores could be detected in a pot of soil to which fresh manure had been added.

"These results throw considerable doubt on the common assumption that these organisms are important ammonifiers in the soil. They raise the question as to what possible soil conditions favor their growth and multiplication."

A possible function of Actinomycetes in soil, H. J. Conn (*Jour. Bact., 1 (1916), No. 2, pp. 197–207*).—Studies conducted at the New York State Experiment Station on the number and activities of Actinomycetes in fine sand, fine sandy loam, sandy loam, muck, stony loam, silty clay loam, loam, and gravelly loam soils are reported.

It was found that, in general, more colonies of Actinomycetes developed on plates made from sod soil than on those from cultivated soil. The average ratio between their numbers in neighboring sod and cultivated spots in the same soil type was slightly over 2:1. The maximum ratio was about 6:1. Actinomycetes averaged about 38 per cent of the total flora of sod soil, as determined by means of gelatin plates, but only about 20 per cent of the total flora of cultivated soil. In a study of three neighboring spots in a single soil type, it was found that with few exceptions Actinomyces colonies not only appeared in greater numbers from sod than from cultivated soil, but also in greater numbers from old sod than from sod only two or three years old. "A probable explanation for this difference in numbers seems to be that Actinomycetes are active in the decomposition of grass roots."

The relation of protozoa to certain groups of soil bacteria, T. L. Hills (*Jour. Bact., 1 (1916), No. 4, pp. 423–433*).—Experiments conducted at the Wisconsin Experiment Station on the effect of protozoa on ammonification, nitrification, and nitrogen fixation in silt-loam soil are reported.

It was found that "in the soil cultures the presence of protozoa under the conditions of the experiments did not have any noticeable effect, detrimental or otherwise, on the processes of ammonification, nitrification, and free nitrogen fixation. In the case of the liquid cultures employed in the study of free nitrogen fixation the conditions were at an optimum for the development of the protozoa, and under these circumstances they limited bacterial activity as evidenced by the harmful effect on the fixation of free nitrogen. Undoubtedly under these conditions the protozoa were active in destroying the Azotobacter cells."

Sterilization of the soil, R. S. Cunliffe (*Estac. Expt. Agron. Cuba Bol. 29 (1916), pp. 17, pls. 12*).—This bulletin describes methods of soil sterilization used in Cuba and the results obtained.

The fire method is considered to be crude and uncertain. The use of antiseptics is expensive and is deemed inferior to the use of hot water and steam. The details of the method of steam sterilization practiced at the Cuba Experimental Station are presented, and it is concluded that this method has passed the experimental stage to an extent to make it of considerable practical value on plantations in Cuba, especially where the agriculture is intensive.

Green manuring experiments, J. A. Voelcker (*Woburn Expt. Sta. Rpt. 1915, pp. 15–17; Jour. Roy. Agr. Soc. England, 76 (1915), pp. 329–331*).—Green manuring experiments with corn on light soil are reported showing that the plowing in of leguminous crops, such as tares, did not give a return equal to that resulting from the plowing in of nonleguminous crops, such as rape or mustard. The soils receiving tares, however, contained more moisture, organic matter, and nitrogen than the nonleguminous soils.

Availability of potash in certain orthoclase-bearing soils as affected by lime or gypsum, L. J. Briggs and J. F. Breazeale (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 1, pp. 21–28*).—Experiments are reported in which "samples of pegmatite and orthoclase were collected near Riverside, Cal., representing, respectively, types of the potash-bearing rock and mineral from which many of the citrus soils appear to be derived. These samples were finely ground and shaken for a number of days with aqueous solutions of calcium hydroxid and of calcium sulphate in graduated concentrations. The calcium-hydrate solutions did not modify the solubility of the potassium in either pegmatite or orthoclase. Gypsum solutions depressed the solubility of potassium in orthoclase, the quantity of potash in solution decreasing progressively as the concentration of the calcium sulphate increased.

"Similar tests were made upon a virgin soil of a granitic type from the experiment station near Riverside, Cal. The solubility of the potash was not measurably different in distilled water and in solutions of calcium hydrate or calcium sulphate.

"The addition of calcium sulphate to a citrus soil which had been under cultivation for some time and which was more granular and less weathered than the virgin soil decreased the solubility of the potash.

"The potassium content of wheat seedlings was practically the same when grown (1) in water containing finely ground orthoclase, and (2) in a saturated calcium-sulphate solution containing the same quantity of orthoclase. Similar experiments in which a citrus soil was used instead of orthoclase showed a decreased absorption of potassium by wheat seedlings in the presence of calcium sulphate.

"The experiments indicate that the availability to plants of the potash in soils derived from orthoclase-bearing rocks is not increased by the addition of lime or gypsum. In some instances a marked depression of the solubility of the potash in the presence of gypsum was observed."

Acidity of soils and lime requirements, J. A. Voelcker (*Woburn Expt. Sta. Rpt. 1915, pp. 41–43; Jour. Roy. Agr. Soc. England, 76 (1915), pp. 355–357*).—The results obtained in these experiments are similar to those obtained in the 1914 experiments (E. S. R., 35, p. 324).

Chalking: A useful improvement for clays overlying the chalk, E. J. Russell (*Jour. Bd. Agr. [London], 23 (1916), No. 7, pp. 625–632, pl. 1, fig. 1*).—This is a brief account of the method and cost of obtaining and using chalk on stony clay soils in the English counties surrounding the city of London, together with a brief review of results showing the effect of chalk on different crops.

The relation of lime to magnesia in soils, J. A. Voelcker (*Woburn Expt. Sta. Rpt. 1915, pp. 37–41, pls. 2; Jour. Roy. Agr. Soc. England, 76 (1915), pp. 351–355, pls. 2*).—Experiments on the effect on wheat of adding caustic lime and calcium carbonate to soils containing an excess of magnesia and of adding caustic magnesia and magnesium carbonate to soils containing an excess of lime are reported.

In the first case the conclusion was reached that "lime may be added in considerable excess of the magnesia present provided it be put on in the form of carbonate of lime and not as caustic lime." In the second case the results were not conclusive.

Influence of magnesia on wheat, J. A. Voelcker (*Woburn Expt. Sta. Rpt. 1915, pp. 17–20; Jour. Roy. Agr. Soc. England, 76 (1915), pp. 331–334*).—Experiments with wheat on two 1/20-acre plats of soil containing 0.46 per cent of calcium oxid and 0.28 per cent of magnesium oxid, to which ground magnesia was added at the rate of 4 tons per acre, showed that the wheat on

the magnesia plat was darker in color, stronger, and better tillered out than on the untreated plat. The total yield was also greater on the magnesia plat. On plats of previous experiments, it was found that the wheat crop showed after three years a slight advantage from the application of magnesia.

The influence of strontium salts on wheat, J. A. VOELCKER (*Woburn Expt. Sta. Rpt. 1915, pp. 30–37, pls. 2; Jour. Roy Agr. Soc. England, 76 (1915), pp. 344–351, pls. 2*).—Experiments on the influence of the sulphate, nitrate, hydrate, chlorid, and carbonate of strontium on wheat in light unproductive soil when added in amounts equivalent to 0.05 and 0.1 per cent of strontium are reported.

It is concluded that "strontium in the form of the sulphate, the hydrate, and the carbonate, is, when given up to 0.1 per cent, practically without effect either on the germination of the seed or the increase of the crop. Strontium used in the form of nitrate produces an increase of crop, but this can not be attributed to the presence of strontium. Strontium applied as chlorid has a retarding effect on germination and, when used in quantity approaching 0.1 per cent of strontium, has a distinctly toxic effect."

Experiments on the influence of boric acid and borax on wheat when added in amounts equivalent to 0.1, 0.05, 0.02, 0.01, 0.005, 0.001, 0.0005, 0.00025, and 0.0001 per cent of boron and on barley when added in amounts equivalent to from 0.001 to 0.0001 per cent boron are also reported. It is concluded that "germination is retarded when over 0.003 per cent of boron is used, and even 0.001 per cent, more especially with borax, seems to delay germination. Over 0.001 per cent of boron, either as boric acid or borax will prevent plants from developing and forming grain. A toxic influence is shown with 0.0005 per cent of boron, but with quantities not exceeding 0.00025 per cent there is a slightly stimulating effect. The effects generally are more marked with borax than with boric acid."

Action of manganese, iron, and copper on the growth of plants, H. VAGELER (*Landw. Vers. Stat., 88 (1916), pp. 159–242; abs. in Jour. Chem. Soc. [London], 110 (1916), No. 644, I, p. 457; Chem. Abs., 10 (1916), No. 20, p. 2609*).—Water culture experiments with oats, lupines, and beans, pot experiments with oats and lupines, and field experiments with oats are reported.

"In the water cultures the amounts of manganese sulphate, iron sulphate, and copper sulphate employed were, respectively, 0.482, 0.556, and 0.042 gm. per liter. No stimulating effects were observed in the water-culture experiments, and addition of calcium and sodium chlorids failed to diminish the poisonous effects, which were much the greatest in the case of copper sulphate. Beans were much less sensitive to copper than oats. In the pot experiments iron and copper slightly reduced the yield of oats, especially in sand, while manganese had no effect either in sand or in loam. Lupines were benefited both by iron and copper but not by manganese. In the field experiments the three metals had practically no effect."

Concerning the use of commercial fertilizers in 1916 (*Vermont Sta. Circ. 10 (1915), pp. 16*).—This is a summary of the opinions expressed at a meeting of the directors of the experiment stations of the North Atlantic States as to the best procedure in maintaining soil fertility in those States in view of the present abnormal fertilizer situation.

Analyses of commercial fertilizers (*New York State Sta. Bul. 425 (1916), pp. 413–471*).—This bulletin gives the results of analyses by the station of samples of fertilizers collected by the commissioner of agriculture of New York during 1916. Attention is called to the fact that because of the abnormal trade conditions no attempt is made to give approximate commercial valuations of the fertilizers.

Official report on commercial fertilizers licensed, inspected, and analyzed during the year 1914 (*Agr. Com. Ohio, Off. Rpt. Com. Fert., 1914, pp. 273*).—In addition to a large amount of general information regarding the selection, purchase, and use of commercial fertilizers in Ohio, this report contains the results of actual and guarantied analyses of 726 samples of fertilizers and fertilizing materials offered for sale in Ohio during 1914.

Commercial fertilizers, W. B. CADY (*Porto Rico Bd. Agr. Expt. Sta. Bul. 16 (1916), pp. 12*).—This bulletin gives a brief general discussion of fertilizers in relation to crop production, and reports the results of actual and guarantied analyses and valuations of 106 samples of fertilizers and fertilizing materials offered for sale in Porto Rico.

Commercial fertilizers, J. L. HILLS, C. H. JONES, and G. F. ANDERSON (*Vermont Sta. Bul. 198 (1916), pp. 5–49*).—This bulletin reports the results of actual and guarantied analyses of 168 samples of fertilizers and fertilizing materials, representing licensed brands collected for inspection in Vermont during 1916, together with a discussion of results and other data. It was found that 82 per cent of the brands analyzed met their guaranties. Owing to abnormalities in the trade in crude chemicals no valuations are given.

AGRICULTURAL BOTANY.

Hereditary reaction system relations—an extension of Mendelian concepts, R. E. CLAUSEN and T. H. GOODSPEED (*Proc. Nat. Acad. Sci., 2 (1916), No. 4, pp. 240–244*).—As preliminary to a more detailed statement to appear later, the authors report briefly some results of observation and experimentation carried on for about ten years at the university of California on the monotypic species *Nicotiana sylvestris* and a number of the varieties of *N. tabacum*.

When any one of these varieties is crossed with *N. sylvestris*, the F_1 hybrid nearly, or completely, reproduces on a larger scale the characters of the Tabacum variety used in the cross, somatogenesis in these cases appearing to be dominated by the Tabacum system as a unit. It is thought that if these F_1 hybrids be considered to represent the reaction end-product of two fundamentally dissimilar reaction systems, the relations of the two systems, as here manifested, indicate a rather extensive mutual incompatibility of the elements of the two systems.

This deduction is supported by the fact that these hybrids produce only a few functional ovules, the number being apparently constant within rather narrow limits. These functional ovules are considered to represent the *N. tabacum* and *sylvestris* extremes of a recombination series, the vast majority of the members of which fail to function on account of being built up of incompatible elements from the two systems.

The deduction is made that the type of behavior displayed by species hybrids may be considered as dependent upon the degree of incompatibility of the reaction systems involved, sterility in such cases being merely a logical consequence of such incompatibility and an expression of its extent. The implications of the conceptions of such a reaction system are discussed.

On the composition of a factorial formula for zygotes in the study of inheritance of seed characters of Zea mays with notes on seed pigments, K. FUJII and Y. KUWADA (*Bot. Mag. [Tokyo], 30 (1916), No. 351, pp. 83–88*).—The authors report studies on two conditions which, it is thought, may account for disagreements between theoretical expectations and experimental results met with by various investigators in studying inheritance of seed characters in maize.

In connection with a discussion of the triploid nature of the endosperm in maize, a new formula is proposed for the F_1 zygote, *AA.a* being the zygotic formula supposed to apply when the plant with the gametic formula *A* has been taken as the maternal plant, and *aa.A* when the plant with the gametic formula *a* has been taken as the maternal plant. The dominant factor *A* being duplicated in the first of these cases, seeds of the darker blue or black color are produced, while that factor is single in the second case, giving light blue.

The difficulties of interpretation of zygotic distribution concerning colors on an ear of dihybrid and polyhybrid maize plants are supposedly due to several conditions, one of which is noted above. Another is believed to be the occurrence of two kinds of similar pigments, which were detected by microchemical and macrochemical tests briefly described. These may occur in the same seeds and may impair the reliability of genetic studies in such cases.

Observations on inheritance of sex-ratios in Mercurialis annua, C. YAMPOLSKY (*Mem. N. Y. Bot. Gard., 6 (1916), pp. 69–74*).—Observations extending to the F_5 generation of *M. annua*, and still in progress, appear to negative the assumption that either one or the other of the sexes has two kinds of gametes.

Inheritable variations in the yellow daisy (Rudbeckia hirta), A. F. BLAKESLEE (*Mem. N. Y. Bot. Gard., 6 (1916), p. 89*).—Among the variations noted, most of which appear to be inheritable in the wild yellow daisy, are such as relate to the absence or presence, somewhat definite numbers, position, width, shape, and coloration of rays; to the shape, size, and color of the disk; and to such vegetative characters as height, branchings, fasciations, and leaf size and shape. Other characters are being investigated.

A tetracotyledonous race of Phaseolus vulgaris, J. A. HARRIS (*Mem. N. Y. Bot. Gard., 6 (1916), pp. 229–244, figs. 3; Proc. Nat. Acad. Sci. 2 (1916), No. 6, pp. 317, 318*).—An account is given of the study of a teratological race of *P. vulgaris* which originated in the progeny of a plant grown in 1907, all the characteristics of its origin being characteristic of de Vriesan mutation.

The race has proved to be practically constant for the four generations during which the offspring have been studied. While it is designated as tetracotyledonous for lack of a better descriptive term, the cotyledons (most frequently four in number) are highly variable, the primordial leaves being still more so. A low degree of correlation has been noted between cotyledon number and leaf number.

Self, close, and cross fertilization of beets, H. B. SHAW (*Mem. N. Y. Bot. Gard., 6 (1916), pp. 149–152, pl. 1, fig. 1*).—Having found that under isolation tents of material having meshes as fine as the finest used by European writers fertilization occurred to the amount of about 23 per cent in case of seed beets, and having concluded that cross-fertilization is usually possible owing to the coarseness of the meshes in the cloth available for this purpose, the author separated his growing seed beets by intervals of at least two miles. The highest resulting percentage of seed in no case rose above 2.29 per cent. Several plants which remained sterile showed a development otherwise normal.

Experiments carried out are thought to show that in cross-pollination between two different plants of the same progeny the percentage of potential fertilization appears to be 100 per cent, being limited in practice only by the technique. Close pollination between flowers of different stems of the same plant resulted in fertilization in 8.54 per cent of the cases and in carpel stimulation (to growth) in 3.47 per cent. Close pollination between flowers of different spikes resulted in fertilization in 5.23 per cent of the cases and in carpel stimulation in 5.8 per cent. Close pollination between different flowers of the same spike resulted, according to technique, in pollination in from 2.7 to 2.63 per cent and in stimulation in 1.43 to 5.26 per cent of the cases. Self-pollination resulted in neither fertilization nor carpel stimulation in any case.

It is thought probable that minute biochemical differences exist which increase in magnitude as the physical intimacy or relationship decreases.

Self-pollinations and cross-pollinations in Cichorium intybus with reference to sterility, A. B. Stout (*Mem. N. Y. Bot. Gard., 6 (1916), pp. 333–454, pl. 1*).—The author, concluding an extensive report and discussion of pollination studies dealing more particularly with *C. intybus*, states that a marked degree of similarity in constitution between male and female gametes is the most fundamental necessity to sexual fertility. Obvious anatomical differences are deemed to a large degree superficial and unessential.

The presence of both self-fertility and cross-fertility within a nondimorphic species or strain, as in *C. intybus*, is considered to show that incompatibility is fundamentally independent of visible differentiaton. The evidence on the whole favors the view that for successful fertilization the element of similarity in cell organization and in the physical, chemical, idioplasmic, and structural properties of all the cells and tissues involved is more important than any dissimilarity that can be associated with sex differentiation.

The results in chicory also show that the development of self-incompatibility is not closely correlated with conditions in the immediate parentage. In physiological incompatibilites that appear in the selfing and crossing in such nondimorphic species as *C. intybus* and *Cardamine pratensis*, also in such dimorphic species as *Primula sinensis*, it appears that the grade of sex differentiation within the individual may involve sufficient relative dissimilarity to limit or prevent pollination.

Studies on the blooming of hemp, G. Havas (*Kisérlet. Közlem., 18 (1915), No. 5–6, pp. 908–919, pls. 2, figs 5*).—The modes of succession in the appearance of blooms at different levels of both male and female plants of *Cannabis sativa* are described. It is stated that blooming and pollen dispersal by the male flowers (the period between which occupies about seven hours) occur mainly during the night and morning, a minimum rate prevailing in the latter part of the night and the forenoon.

The persistence of the style on fruits, C. Campbell (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 25 (1916), I, No. 3, pp. 178–183, figs. 2*).—Cases are described, chiefly in lemons, in which the persistence and development of the style after fertilization resulted in a deformed fruit. It is thought that in case of relatively rapid development just after pollination the formation of a fission layer proceeds normally, while in case of slower development this does not occur and the persistent style develops as part of the fruit.

The determinative action of environic factors upon Neobeckia aquatica, D. T. MacDougal (*Flora [Jena], n. ser., 6 (1914), No. 3, pp. 264–280, figs. 14*).—Experimentation through which *N. aquatica* has been carried, including the keeping of cultures as terrestials or aquatics in environments and under conditions differing very widely, has shown that this plant, which endures an extremely wide range of conditions, is capable of considerable modifications in several directions by alternations of environment. The changes appear not to be adaptive in many cases, though determined by environment to a much greater degree than in case of Proserpinaca, Sium, or probably any other so-called polymorphic species, yet the reaction to such external agencies is not considered to be a direct or physical adjustment.

Plant ecology and the new soil fertility, C. B. Lipman (*Mem. N. Y. Bot. Gard., 6 (1916), pp. 319–321*).—This is a brief discussion of the benefit considered to be derivable from closer cooperation between plant ecologists and soil scientists regarding such factors as the composition and concentration of

the soil solution, balance between the soil solution components, forms of nitrogen suitable for plants, the influence of quantity and quality of organic matter, the proper basicity or acidity for a given plant, and the mutual influence of plants growing together.

Growing plants in large containers under control conditions, R. C. WRIGHT (*Jour. Amer. Soc. Agron., 8 (1916), No. 2, pp. 113–116, pl. 1, figs. 2*).—A description is given of an arrangement adapted to the growing of plants under controlled and yet nearly natural conditions. It comprises a soil container in bucket form, of heavy corrugated iron, 15 in. in diameter by 13 in. deep, provided with drainage holes in the bottom and placed in a well made by sinking terra cotta sewer tiles to within 2 in. of the surface of the ground. The cans are handled and weighed by means of a block and tackle and a movable derrick. The data obtained are presented and discussed. The temperature conditions in the cans are said to be kept fairly uniform and to be practically those of natural soil.

An apparatus for aerating culture solutions, P. WEATHERWAX (*Proc. Ind. Acad. Sci., 1914, pp. 157–160, fig. 1*).—It is stated that the requirements incident to experiments on various phases of plant physiology have led to the development of an apparatus for the maintenance of a constant stream of air for several days. This has proved to be very efficient for that purpose and is now being used very successfully in the aeration of culture solutions. The principle is that of the Sprengel mercury pump, the adaptations of which are described. It is claimed that the economy and the wide range of adjustment in this instrument are such as to allow its use for many other purposes.

Preliminary report on synthetic media, C. J. T. DORYLAND (*Jour. Bact., 1 (1916), No. 2, pp. 135–152*).—The term synthetic media is here used to mean one containing only compounds of known composition and structure, including both nutrient solutions and solid (synthetic) media formed by the precipitation of an agglutinant from compounds of known composition and structure. The author reports on an attempt, by the use of definite sources of energy and nitrogen, to exclude all species but those which can use the particular source employed in each case, thus limiting greatly the number of groups, also that of individuals, present in any case. The schematic arrangement presented is tentative and is limited to water-soluble compounds. Sixteen media have been tested up to the present time, promising results having been obtained.

The mechanism and conditions of growth, D. T. MACDOUGAL (*Mem. N. Y. Bot. Gard., 6 (1916), pp. 5–26, pl. 1, figs. 4*).—The author presents results of experimentation with the platyopuntias, thought to have an important bearing on the main problems of growth, which requires building material of a highly specific character, as exemplified in the author's results from studies with the polymorphous plant Neobeckia (see p. 523).

He states that joints or segments of the platyopuntias accomplish nearly all of their total enlargement during 60 to 100 days of the initial season in the Tucson climate. Enlargement and secondary growth may take place as determined by branching and environic factors in the succeeding seasons, the changes in volume of joints, including daily reversible alterations which are described, amounting to 1/250 of the total length. The general features of the daily growth record suggest that enlargement takes place after the smothering or clogging acids have been broken down, and that it ceases when the supply of building material is greatly reduced.

The direct action of light on protoplasts and on body temperatures is to be described in a later paper.

The nature of mechanical stimulation, W. J. V. OSTERHOUT (*Proc. Nat. Acad. Sci., 2 (1916), No. 4, pp. 237–239, fig. 1*).—The author observed that when a cell of the marine alga *Griffithsia bornetiana* was touched near one end, the surfaces of the chromatophores in this region became permeable to their red pigment. This soon began to diffuse out into the surrounding protoplasm, rendering the other chromatophores, as successively reached, permeable in like manner, a wave of stimulation thus progressing until the other end of the cell is reached by the wavelike changes. It is thought that the alterations set up in the successive cells, resulting in diffusion of red pigment (and probably other substances), are chemical in their nature.

The disturbance is thought to originate as a mechanical rupture of the surface layer of the chromatophore, as a number of cellular structures are known to possess surface layers of great delicacy. Reactions are supposed to occur between the diffused contents and other substances as encountered. Physical alterations in the protoplasm may thus give rise to chemical changes, and responses to contact and mechanical or gravitational deforming stimuli may thus be explained. In this conception of mechanical stimulation the essentials are substances separated by semipermeable membranes, production of a rupture in these which is not at once repaired, and a resulting reaction which produces the characteristic visible response to the stimulus.

Energy transformations during the germination of wheat grains, LUCIE C. DOYER (*Rec. Trav. Bot. Néerland., 12 (1915), No. 4, pp. 369–423, pls. 2*).—Giving a bibliography and more extensive data than in a previous report (E. S. R., 35, p. 632), the author states that in the germination of wheat grains the loss of energy increased for seven days, particularly on the third day. The loss during the first two days, when imbibition was relatively important, was comparatively small.

Heat evolution also increased with the progress of germination, the increase being most marked on the third and the fourth day, and the rate being increased with a rise of temperature up to 35° C. (95° F.), the heat development more than doubling with a rise of 10°. At 40° heat development began to diminish. Respiration was increased during germination at a temperature of 25°, the increase being greater in the early period of germination. During the first six days of germination at 25° the amount of heat given up was less than the loss of energy set free by respiration. Heat development had its optimum at 35°, which is higher than the optimum for respiration. There appears, therefore, to be no constant relation between heat development and respiration.

A study of the relation of soil moisture to transpiration and photosynthesis in the corn plant, T. G. YUNCKER (*Plant World, 20 (1916), No. 6, pp. 151–161, figs. 4*).—Experiments to determine the relation between the amount of transpiration and photosynthesis in corn plants and the degree of soil moisture in which they were grown are described.

The author reports, in regard to three tests made, that the plants in soil watered to 25 per cent of saturation weighed the most per unit of leaf area, those in that at 65 per cent the least, while those at 45 per cent showed an intermediate increase of weight and inferentially of photosynthetic activity. The water requirement was less for plants in the drier than for those in the wetter cultures. Transpiration rates showed the same relation to moisture content as did the water requirement. It thus appears that the amount of organic matter formed is not proportional to transpiration.

On the relation between the rate of root growth and oxygen, W. A. CANNON (*Abs. in Science, n. ser., 44 (1916), No. 1143, p. 761*).—A series of experiments is reported in which the roots of *Prosopis velutina* and *Opuntia versi-*

color were exposed to atmospheres of pure carbon dioxid and of atmospheric air so diluted with carbon dioxid that the mixture contained from 5 to 25 per cent of oxygen.

The roots of the species were found to maintain a feeble growth rate in an atmosphere containing as little as 5 per cent of oxygen, but growth stopped in both species in pure carbon dioxid. Recovery from the asphyxiation occurred sooner in Prosopis than in Opuntia and in both sooner at high than at low soil temperatures. The results are believed to indicate that the response of the roots of Opuntia to a diminished oxygen supply, such as occurs with increasing depth below the surface of the ground, is a contributory factor in bringing about the superficial placing of roots.

The embroyo sac and pollen grain as colloidal systems, F. E. Lloyd (*Mem. N. Y. Bot. Gard., 6 (1916), pp. 561–563*).—The author reports very briefly on certain observations made on the behavior of protoplasm, which is recognized as a hydrophile emulsion colloid, showing alterations corresponding to changes in water content and space relations of the dispersoids and the disperse medium. He admits that it is not possible at the present stage of knowledge to discount the views of Borowikow (E. S. R., 33, p. 28) that the agents concerned in swelling are also concerned with growth, since we do not yet know how swelling, shrinking, and coagulating reagents affect the relation of change of hydration to the capacity of protoplasm to secrete and to hold water within the vacuoles, the solutions, suspensions, etc., of which are unknown but complex as regards composition and behavior.

Contents of amylase in ripening seeds of horse beans, A. Blagoviêshchenskiĭ (Blagoveschtschenski) (*Zuhr. Russ. Fiz. Khim. Obshch., Chast Khim., 47 (1915), No. 6, pp. 1529–1532; abs. in Jour. Chem. Soc. [London], 110 (1916), No. 639, I, p. 109*).—It was found that in seeds of *Vicia faba minor* the amount of amylase present corresponded approximately to the rate of starch accumulation. This is considered as evidence of the synthesizing action of amylase in the ripening seeds, the lack of complete parallelism being attributed to the loss of some of the starch from the assimilatory organs.

Present status of the problem of the effect of radium rays on plant life, C. S. Gager (*Mem. N. Y. Bot. Gard., 6 (1916), pp. 153–160.*)—The evidence is here briefly reviewed, as obtained by various investigators including the author, since the publication of his previous summation of the known related facts (E. S. R., 20, p. 1124). It is considered to justify the broad inference that although radio-activity may act as a stimulation to plant growth, our present knowledge regarding the cause and the effects of that agent warrants little, if any, hope of its profitable utilization in practical agriculture.

The influence of ultraviolet rays on phosphorescent bacteria, F. C. Gerretsen (*Centbl. Bakt. [etc.], 2. Abt., 44 (1915), No. 17–23, pp. 660, 661*).—Reporting the results of some preliminary experiments, the author states that *Photobacterium phosphorescens* exhibited luminosity and the function proper to catalase for several hours after being killed by means of ultraviolet rays.

The influence of inorganic salts on the development of Actinomycetes, III, F. Münter (*Centbl. Bakt. [etc.], 2. Abt., 44 (1916), No. 24–25, pp. 673–695, figs. 9*).—Continuing previous work (E. S. R., 31, p. 324), the addition of 5 per cent of potassium chlorid, sodium chlorid, potassium nitrate, and sodium nitrate to nutritive media was found to increase growth markedly, but decreased spore formation in Actinomycetes. The addition of 10 per cent arrested development in nearly all cases. The corresponding salts of magnesium hindered growth, and magnesium carbonate arrested it completely. Spore formation was increased by small but decreased by larger additions of the chlorids, nitrates, and carbonates of calcium, barium, and strontium, the carbonates,

however, appearing relatively indifferent. Silver and copper were very unfavorable to growth, mercury less injurious, and lead and iron salts the least hurtful to vegetative growth. Low concentrations of the nutritive components hastened spore formation.

Note on the nitrogen nutrition of mold fungi, W. Brenner (*Centbl. Bakt.* [*etc.*], *2. Abt., 44* (*1915*), *No. 9–13, pp. 304, 305*).—Besides a few corrections and comments on statements made in the previous article (E. S. R., 32, p. 327), a few additions, of contributions not later than 1913, are made to the bibliography previously given.

Variations in nodule formation, L. T. Leonard (*Jour. Amer. Soc. Agron.,* *8* (*1916*), *No. 2, pp. 116–118*).—In view of the observed differences in the degree of inoculation exhibited by legume varieties, and even by individual plants, exposed to the nodule-forming organism, the author tested 19 varieties of soy beans with cultures taken from one of them. He obtained nodules in case of each variety, only one requiring a third inoculation.

The present state of our knowledge of the physiological significance of the mycorrhizæ of trees, D. L. Petri (*Internat. Inst. Agr.* [*Rome*], *Mo. Bul. Agr. Intel. and Plant Diseases, 6* (*1915*), *No. 9 pp. 1138–1151*).—The author concludes a review of the studies and views of various authors regarding the real nature of the relations between the roots of trees and the mycorrhizæ found in connection therewith by stating that the results of 30 years of scientific research, at least so far as arborescent plants are concerned, have not led to either confirmation or rejection of the theory of mutuality.

FIELD CROPS.

The use of checks and repeated plantings in varietal tests, F. J. Pritchard (*Jour. Amer. Soc. Agron., 8* (*1916*), *No. 2, pp. 65–81, figs. 3*).—This article is a discussion of the methods used in field-variety tests. The experiments were conducted with sugar beets in an attempt to determine three things: (1) The optimum frequency of checks; (2) whether the best frequency of checks is efficient enough for satisfactory comparisons; and (3) the measure of the comparative effect of repeated plantings upon the experimental error. The results are discussed in detail, and the general conclusions drawn are as follows:

(1) The practice of dispensing with check rows and using the mean of all progeny rows as a standard of comparison appears to be less efficient than the employment of frequent checks; (2) check rows 32 in. from the progeny row varied less than those 64, 96, 128, and 160 in. distant; when the probable error was duly taken into account the last four distances appeared to be good checks; (3) the use of alternate rows as checks did not offset the variability in yield due to irregularities of the soil; and (4) the experimental error was reduced about 50 per cent by means of 10 replications and alternate check rows.

The mode of pollination in some farm crops, M. N. Pope (*Jour. Amer. Soc. Agron., 8* (*1916*), *No. 4, pp. 209–227*).—This article is a review of the literature, corn, wheat, oats, barley, rice, rye, and flax being discussed specifically. A bibliography of the literature cited is included.

The identification of grasses by their vegetative characters, L. Carrier (*U. S. Dept. Agr. Bul. 461* (*1917*), *pp. 30, figs. 60*).—Following the work of other investigators the author presents a plan of classification to identify grass seedlings based somewhat on that of Percival (E. S. R., 12, p. 719), but including a larger number of grasses. The botanical characteristics of grasses before the blooming stage are described and the use of the key discussed.

The small grains have been placed in a separate group in order to emphasize the differences that occur among themselves. The grasses studied are all common to the eastern United States, the distinctively western species being excluded.

In addition to the analytical key, detailed descriptions of 48 seedling grasses and 8 small grain seedlings are given and illustrated.

Dry farming in Utah, F. S. Harris and A. D. Ellison (*Utah Sta. Circ. 21* (*1916*), *pp. 3–35, figs. 15*).—This circular is a general discussion of dry farming in Utah, with recommendations regarding the selection and management of land for dry-farming purposes. Dry-farm crops for Utah are listed as follows: Wheat, rye, oats, barley, emmer, potatoes, corn, peas, beans, alfalfa, the sorghums, and certain miscellaneous crops, as the grasses, clovers, flax, etc. Other points discussed are seed selection, cultural methods, cropping systems, storage of water in the soil, irrigation as a supplement to dry farming, and dry-farm equipment. A general summary of the discussion is as follows: (1) Dry farms should not be located in regions having less than 12 in. of rainfall a year; (2) the soil should be uniform and deep and should support a good natural growth, preferably of sagebrush; (3) new land should be plowed a year before planting a dry-farm crop and fallowed each alternate year; (4) deep plowing and thorough tillage during the following year are necessary to conserve moisture; and (5) irrigation is often a valuable supplement to dry farming.

A twenty-year comparison of different rotations of corn, potatoes, rye, and grass, B. L. Hartwell, S. C. Damon, et al. (*Rhode Island Sta. Bul. 167* (*1916*), *pp. 38*).—This reports the results of investigations with different crop rotations, and fertilizer studies in connection with them, which were begun in 1893. Previous reports have appeared, giving the methods of planting, care, fertilizer formulas, and details regarding each rotation (E. S. R., 7, p. 396; 12, p. 1030; 13, p. 34; 15, p. 144; 16, p. 150; and 21, p. 730).

The rotations were as follows: Three-year—potatoes, rye and rowen, and grass; 4-year—potatoes, rye and rowen, grass, and corn; 5-year—potatoes, rye and rowen, grass, grass, and corn; 5-year—potatoes, rye, grass, grass, and corn; and 6-year—potatoes, rye and rowen, grass, grass, grass, and corn. In the early spring 3 lbs. of alsike and 4.5 lbs. of red clover per acre were sown on all plats except those of the second 5-year rotation.

The cultural methods practiced toward the end of the 20-year period are discussed for each crop, and the fertilizer treatments for the various crops for the entire period are given in tabular form. The yield of each crop for each year of the experiment is also tabulated and the averages for each rotation briefly discussed.

The average yields per acre for all crops at the time of harvesting were 207 bu. of potatoes over 2 oz.; 17 bu. of rye, 1.57 tons of straw and 0.66 ton rowen; 3.16 tons first-year hay and rowen; 3.08 tons second-year hay; and 58 bu. hard corn. The highest yield of marketable potatoes, 223 bu., was secured from the 6-year rotation, the 5-year rotation without legumes being second with 216 bu. The highest yield of rye grain, 19 bu., and straw, 1.7 tons, was secured from the 3-year rotation. The highest hay yields were secured from the 6-year rotation regardless of the number of years removed from seeding. The highest yields of corn, 63 and 61 bu., were secured from the 4 and 6 year rotations, respectively.

The comparative effect of manure and chemical fertilizers on yields is discussed, and the conclusion drawn that there was no decided difference in the corn yields when 4 cords of stable manure or chemical fertilizers, furnishing 30 lbs. of nitrogen, 80 lbs. of phosphoric acid, and 60 lbs. of potash, were used.

The data also failed to show that there was any positive difference in the yield of the potatoes following the corn.

For the purpose of comparing the rotations the crops were given arbitrary values as they were harvested and, after deducting charges for production and fertilizers, the resulting net return used as a basis for comparison. The 6-year rotation returned the highest average annual net profit of $16.45, with the 3-year rotation second and giving a net return of $14.26. The lowest return was secured from the 5-year rotation without legumes and amounted to $11.66.

Nitrogen determinations were made on the surface soil from each plat in the rotations in 1912. All the plats of the 6-year rotation were noticeably high in nitrogen, but further observations are deemed necessary before drawing definite conclusions. The average nitrogen content for all rotations was 0.2342 per cent.

[Field crops] (*Off. Bul. Wyo. Bd. Farm Comrs., 1914, pp. 32–65, 78–82, 90–108, figs. 15*).—Notes are given on the cultivation and agricultural value under dry-farm conditions of wheat, oats, barley, emmer, rye, flax, alfalfa, peas, sweet clover, corn, sweet sorghum, Sudan grass, brome grass, millet, potatoes, rape, sand vetch, and beans. Practically all these crops have proved valuable for this section with the exception of winter oats, winter barley, and emmer. Rate and date of seeding tests and variety tests are in progress with most of the above-named crops.

The winter wheat varieties recommended at the present time are Turkey, Kharkov, and Crimean, and for spring wheat varieties the durum wheats and Spring Ghirka. The preferred rate and date of seeding spring wheat are from 2 to 4 pk. between April 15 and May 1. Kherson and Sixty-Day are deemed the best oat varieties, and should be sown at the rate of about 1 bu. per acre about April 15. Spring barley sown at about April 15 at 1 bu. per acre gave the best results, and Ouchac and Hannchen were the most satisfactory varieties. Flax should be sown at the rate of 20 lbs. per acre about June 1. The Kursk millets are deemed best for seed and forage production. The highest yielding potato varieties were Irish Cobbler, Blue Victor, and Early Ohio. The corn variety tests have not proved very satisfactory owing to the difficulty of securing maturity.

Field experiments, 1915 (*Dept. Agr. and Tech. Instr. Ireland Jour., 16 (1916), No. 2, pp. 237–290*).—The results of field experiments for 1915 are reported and discussed with barley, meadow hay, potatoes, mangles, oats, turnips, and wheat. All the crop experiments except those with barley included tests on peat soil, with special reference to the fertilizer requirements of the various crops. Several experiments with liquid manure are also reported.

Catch crops (*Dept. Agr. and Tech. Instr. Ireland Jour., 16 (1915), No. 1, pp. 120–127*).—A list of forage plants available for autumn catch crops is given.

Forage plants (*Bol. Min. Agr., Indus. e Com. [Brazil], 4 (1915), No. 3, pp. 68–72*).—This article contains a brief discussion of the cultural habits and forage value of several plants native to Brazil.

The history of Kentucky blue grass and white clover in the United States, L. Carrier and Katharine S. Bort (*Jour. Amer. Soc. Agron., 8 (1916), No. 4, pp. 256–266*).—This article reviews references to the natural vegetation of America in an effort to trace the origin of Kentucky blue grass (*Poa pratensis*) and white clover (*Trifolium repens*). The evidence seems to indicate that these two plants were introduced into the United States.

Corn improvement in the Philippines, H. O. Jacobson (*Philippine Agr. Rev. [English Ed.], 8 (1915), No. 3, pp. 216–225, pls. 3*).—This paper discusses the development of the corn crop in the Philippines, with special reference to the

improvement of native flint varieties. A detailed report is given of ear-to-row experiments. Considerable work has been done in developing strains by means of self-pollination, employing the method of Collins and Kempton, previously described (E. S. R., 26, p. 535).

Sea Island cotton, W. A. Orton (*U. S. Dept. Agr., Farmers' Bul. 787* (*1916*), *pp. 40, figs. 13*).—A revision of Farmers' Bulletin 302 (E. S. R., 19, p. 332).

West Indian Cotton Conference, 1916 (*West Indian Bul., 15* (*1915*), *No. 4, pp. 235–329, pl. 1, figs. 2*).—A report of this conference is given.

Flax seed for 1916 sowing (*Dept. Agr. and Tech. Instr. Ireland Jour., 16* (*1916*), *No. 2, pp. 312–315*).—Owing to a scarcity of seed a number of importations of flax have been made from the United States, Canada, Russia, France, Holland, Argentina, Japan, Siberia, and Yorkshire and the results of the tests reported. The imported varieties recommended for use were from Holland, Russia, Yorkshire, Canada, and France.

Concerning the oat crop, J. L. Hills (*Vermont Sta. Bul. 197* (*1916*), *pp. 46–72*).—This article is a compilation of general information relating to the production of oats as a Vermont roughage.

Observations on some degenerate strains of potatoes, F. C. Stewart (*New York State Sta. Bul. 422* (*1916*), *pp. 319–357, pls. 12*).—A number of potato plants from seed grown at Honeoye Falls, N. Y., by the U. S. Department of Agriculture, showed signs of abnormality early in the summer, the trouble being diagnosed as curly dwarf. This bulletin deals with the behavior of those plants and their progeny in 1915, together with some observations on other degenerate strains of potatoes. The object of the study was to add to the knowledge of the forms of degeneration known as leaf roll, curly dwarf, mosaic, and spindling sprout and their relation to the selection of seed potatoes. The bulk of the observations were made on Green Mountain, Jr., with additional notes on the following varieties: State of Maine, Carman No. 2, Long Island Wonder, Knoxal, Rural New Yorker No. 2, Late Victor, Ionia, Pride of Vermont, Green Mountain, and an unknown variety. Careful notes were made of the parent stock and great care exercised in regard to the performance of the progeny.

The striking feature of the observations was the frequency with which the progeny of plants with apparently normal foliage and high yield suddenly degenerate into worthless dwarfs affected with various forms of degeneration. The conclusion is reached that these degenerations (leaf roll, curly dwarf, and mosaic) are closely related disorders, due to the same general, undetermined cause, all transmitted through the seed tubers, the progeny of affected plants almost always becoming affected. Spindling sprout is not correlated with leaf roll, mosaic, or curly dwarf, and its heredity is still undetermined. Evidence is lacking to show that any one of the four forms of degeneration named is communicable from one plant to another except through the seed tubers. They were not due to parasitic organisms nor to unfavorable soil or weather conditions of the current season.

Plants from different tubers of the same plant were found generally similar, and plants from different eyes of the same tuber usually resembled each other closely, although exceptions to both cases were frequently noted. Various combinations of normal, mosaic, leaf-roll, and curly-dwarf plants were obtained from the several tubers of the same plant, and even from the several eyes of the same tuber.

The observations recorded led to the following general conclusions having a practical bearing on seed-potato selection: Normal foliage and high yield is not a guaranty of production in the progeny of the following season, as degeneration may occur quite suddenly. It is unsafe to select seed potatoes from a field con-

taining many degenerate plants, as even the normal plants in such a field may produce worthless progeny. Mosaic is transmitted through the seed and, owing to the difficulty of diagnosis, threatens to become an important factor in seed-potato production. In view of these observations it is doubtful if any method of selection can entirely prevent the degeneration of potato varieties under certain conditions due to the "running out" of the seed.

Some disappointing seed potatoes, F. H. Hall (*New York State Sta. Bul. 422, popular ed. (1916), pp. 8, figs. 3*).—This is a popular edition of the above.

Potatoes, C. A. Zavitz (*Ontario Dept. Agr. Bul. 239 (1916), pp. 88, figs. 28*).—This bulletin is a popular discussion of the production of potatoes in the Province of Ontario, including cultural methods, varieties, fungus diseases, insect pests, etc.

Correlative characters of the rice plant, H. O. Jacobson (*Philippine Agr. Rev. [English Ed.], 9 (1916), No. 2, pp. 74–119*).—In a study of rice varieties grown on the lowlands of the Philippines a great quantity of data was collected in correlation studies made in an effort to determine the relative values of the most apparent characters, especially in their relation to the period required by a variety to reproduce itself and to the degree of reproduction. Numerous character correlations were studied and the data are given in tabular form and discussed in detail. Some of the most striking results were as follows:

The length of the growing period of rice, if not less than 120 nor more than 180 days, has no appreciable effect on yield. Extra early maturity is to be had at the expense of yield. Late maturity is conducive to loss through disease, insects, etc. A variety that tillers freely produces more grain per hectare than one that does not; but when rice is transplated tillering can be largely regulated by the number of plants set in the hill. Tillering, the number of grains per panicle, and grain size are compensating characters. The long period of development in the rice plant permits of environmental influences not met with in such plants as oats or barley. It appears that the medium characteristics, and not the extremes, result in the highest consistent yields.

The weight of rice grains, H. O. Jacobson (*Philippine Agr. Rev. [English Ed.], 8 (1915), No. 4, pp. 289–291*).—The weights of seed from three different sections of the panicle for 58 varieties of Philippine rice are reported.

An early reference to Philippine rice varieties, H. O. Jacobson (*Philippine Agr. Rev. [English Ed.], 8 (1915), No. 4, pp. 292, 293*).—This is a brief account of some early descriptions of Philippine rice varieties.

A Philippine wild rice, H. O. Jacobson (*Philippine Agr. Rev. [English Ed.], 8 (1915), No. 4, pp. 294, 295, pl. 1*).—This is a description of a Philippine rice identified as *Oryza manilensis*.

The causes of low yields of rice in the Philippines, H. O. Jacobson (*Philippine Agr. Rev. [English Ed.] 8 (1915), No. 4, pp. 262–272, pls. 4*).—A number of factors that tend to decrease the yield of rice in the Philippines are discussed and recommendations made for overcoming them. The most important factors are considered to be (1) lack of irrigation essential to the successful production of the varieties grown, (2) lack of uniformity in varieties, and (3) lack of the proper cultural methods.

Methods used to improve rice culture in the Philippines, H. O. Jacobson (*Philippine Agr. Rev. [English Ed.], 8 (1915), No. 3, pp. 190–206, pls. 3*).—This article classifies the rice varieties in the Philippnes as upland and lowland, and describes the cultural characteristics of each group. Cooperative methods and station methods for variety tests are described, together with extension methods employed to acquaint the rice farmers with the improved varieties and methods of cultivation.

The rate of sowing nursery beds; the age of seedlings when transplanted; the influence of each, H. O. JACOBSON (*Philippine Agr. Rev.* [*English Ed.*], *8* (*1915*), *No. 4*, *pp. 273–279*).—Some notes are given on studies relating to the rate of seeding rice in the nursery and the age of seedlings when transplanted. One cabán (2.13 bu.) is recommended for each 1/20-hectare (0.12 of an acre) seed bed. From 30 to 35 days is regarded as the most suitable age at which to transplant varieties maturing within 150 days, although this will probably vary with individual varieties.

Observations on the influence of area per plant on yield of grain in rice culture, H. O. JACOBSON (*Philippine Agr. Rev.* [*English Ed.*], *8* (*1915*), *No. 4*, *pp. 252–261*).—This article gives the results of a number of tests with three widely differing varieties to determine the effect upon yield of different spacings of rice plants.

The maturing period of rice was not affected by variations in spacing the hills. It is concluded that under intensive cultural conditions the proper spacing must be determined for each variety, as well as the number of seedlings per hill. One seedling per hill, provided with 100 sq. cm., evidently had ample space and could not utilize a greater area. As a general recommendation, 4 seedlings set in hills 20 by 20 cm. proved practical and beneficial. Furthermore, it is pointed out that some such definite scheme of planting would result in a great saving of seed.

Errors in rice fertilizer experiments, H. O. JACOBSON (*Philippine Agr. Rev.* [*English Ed.*], *8* (*1915*), *No. 4*, *pp. 280–282*).—This article is a criticism of some fertilizer experiments with rice, pointing out errors in the management, reasoning, and conclusions.

Consumption of rice in the Philippine Islands, H. O. JACOBSON (*Philippine Agr. Rev.* [*English Ed.*], *8* (*1915*), *No. 4*, *pp. 283–288*).—This article is a brief discussion of the production and consumption of rice in the Philippines since 1909. It is pointed out that there is no tendency toward lessened consumption of rice by the human population.

Some observations on Chinese rice culture, H. O. JACOBSON (*Philippine Agr. Rev.* [*English Ed.*], *8* (*1915*), *No. 4*, *pp. 296–302*).—This article consists of general observations made on rice culture in China.

Rye culture experiments with diminishing seeding and increasing nitrogen fertilization at Pentkowo, BIELER (*Illus. Landw. Ztg.*, *35* (*1915*), *No. 101*, *pp. 654, 655*).—Comparisons were made in seeding different amounts of the same variety and different varieties of rye. Later these experiments were extended to include a comparison of varying amounts of nitrogenous fertilizer and diffrent drill widths in sowing the seed. Some work has also been done in regard to the date of seeding.

The results up to 1915 indicated that rye sown at the rate of 30 lbs. per morgen (48 lbs. per acre), in rows 8 in. apart and with 30 lbs. of nitrogen in sodium nitrate gave the highest yields.

Triple-seeded spikelets in sorghum, A. B. CRON (*Jour. Amer. Soc. Agron.*, *8* (*1916*), *No. 4*, *pp. 237, 238*, *pl. 1*).—This is a report of an abnormality in inflorescence of sorghums in the F_2 progeny of a dwarf feterita hybrid at Amarillo, Tex., in 1915. Several triple-seeded spikelets and a larger number of twin-seeded spikelets in two of the panicles were the unusual characters.

Soy-bean products and their uses, C. B. WILLIAMS (*North Carolina Sta. Circ. 34* (*1916*), *pp. 7*, *fig. 1*).—This is a general discussion of the commercial uses of soy beans, especially as applied to southern conditions. The extraction of the oil in this country and abroad is briefly described, together with statistics relating to soy-bean oil importations for the five-year period ending with 1916, and for the year of 1916. The use of soy-bean meal as a stock feed and

fertilizer and of the beans and their by-products for human consumption is discussed. It is estimated that from 1 ton of soy beans 1,650 lbs. of meal and 32 gal. of oil can be obtained, leaving a waste composed of trash and moisture of 120 lbs.

[Cultural experiments with different varieties of sugar beets], O. FALLADA (*Österr. Ungar. Ztschr. Zuckerindus, u. Landw., 44 (1915), No. 6, pp. 483–503*).—This article reports the results of cultural experiments with five varieties of sugar beets, viz: Dippe, Zapotil, Schreiber, Dobrowitz, and Rabbethge & Giesecke, Dobrowitz being used as a basis of comparison. The experiments were conducted at four experiment stations, and the meteorological and cultural conditions at each station are tabulated and discussed.

Experiments in transplanting sugar beets, F. J. PRITCHARD and L. E. LONGLEY (*Jour. Amer. Soc. Agron., 8 (1916), No. 2, pp. 106–110, pl. 1*).—This article gives the results of some experiments in transplanting sugar beets with a view to eliminating the expense of thinning. The experiments were planned to determine two points: (1) The relation of the length and size of the seedling at the time of transplanting to the branching of the mature beet; and (2) the influence of the composition of the seed bed on the length, shape, and amount of root branching. The following results were noted:

By transplanting roots from 8 to 12 in. in length a nearly perfect stand of beets was obtained. Roots from 2½ to 5 in. long remained short and branched excessively, although they grew larger than beets started from seed and thinned. A mixture of ¾ sand and ¼ loam produced the longest, least branched, and best shaped roots, although fairly good roots were obtained in a mixture of half and half. The experiments as a whole indicated the possibilities of transplanting sugar beets economically, especially where the roots can be set by means of a machine.

Fertilizing of sugar beets, GERLACH (*Illus. Landw. Ztg., 36 (1916), No. 22, p. 157*).—This article gives the results of some experiments with different amounts of stable manure and commercial fertilizers, both when used alone and together.

In the manure tests the highest returns were obtained from the use of a combination of stable manure and commercial fertilizers. In the commercial fertilizer tests the highest yields were obtained from the use of nitrogenous fertilizers. Recommendations are made for fertilizer treatments based on the results obtained in the experiments.

History of cane varieties in the Philippines, C. W. HINES (*Philippine Agr. Rev. [English Ed.], 8 (1915), No. 3, pp. 152–168, pls. 4*).—A brief history of the production of sugar cane in the Philippines is given. A number of foreign varieties of cane introduced into the Philippines are described briefly, together with a few of the so-called "native" varieties. Field and laboratory tests for the purpose of determining the most profitable varieties for that territory are noted.

Tobacco growing in Ireland (*Dept. Agr. and Tech. Instr. Ireland Jour., 16 (1916), No. 3, pp. 404–410*).—This article is a brief discussion of the tobacco experiments conducted during 1915, and is in the nature of a preliminary report on some more extensive investigations. The general climatic and agricultural conditions pertaining to tobacco culture for the year are discussed.

The origin, characteristics, and quality of Humpback wheat, L. M. THOMAS (*U. S. Dept. Agr. Bul. 478 (1916), pp. 4, pl. 1, fig. 1*).—This bulletin is a brief discussion of the origin and characteristics of Humpback wheat as distinguished from the so-called Velvet Chaff, Glyndon Fife, and Bluestem wheats.

Although Humpback yields well and has proved popular in Minnesota and the Dakotas it is discriminated against by the grain trade because of its alleged

inferior milling qualities. The grade rules for northern spring wheats of the Minnesota State grain-inspection specify that it should not be graded higher than No. 3. Milling and baking tests in cooperation with the North Dakota Experiment Station were conducted with single samples of Humpback wheat from the 1908 and 1909 crops and nine samples from the 1910 crop. These samples were all from Minnesota and were compared with samples of Bluestem and Velvet Chaff wheats of the 1910 crop from North Dakota and Minnesota, with results summarized as follows:

Comparison of results of milling and baking tests of Humpback wheats with other hard red spring wheats.

Kind and source of sample.	Yield of straight flour.	Volume of loaf.		Absorption (water used per 100 gm. of flour).	Color of crumb.	Crude protein (N × 5.7).	
		Per 340 gm. of flour.	Per 100 gm. of flour.			In flour.	In wheat.
Humpback wheats from—	*P. ct.*	*Cc.*	*Cc.*	*Cc.*	*Score.*	*P. ct.*	*P. ct.*
Hoffman, Minn., crop of 1910	69.8	2,176	640	50.5	94.8	14.19	14.95
Kensington, Minn., crop of 1910	72.9	2,105	619	49.0	95.5	13.23	13.59
Both Hoffman and Kensington, crop of 1910	71.2	2,145	531	49.8	95.1	13.76	14.35
Eight samples of Bluestem wheat from North Dakota and Minnesota, crop of 1910	69.2	2,430	715	52.1	97.1	12.59	13.40
Seventeen samples of Velvet Chaff wheat, grown in North Dakota, 1910	66.9	2,428	713	52.4	99.0	13.37	14.52

Although Humpback evidently excels the smaller grain varieties in yield of flour, its volume of loaf, absorption, and color of crumb are below the standard. The rather high percentage of crude protein in the wheat and flour, coupled with low "baking strength," marks a point of resemblance between Humpback and the durum wheats.

Variations in the plants from the same head of wheat, A. J. Ewart (*Jour. Dept. Agr. Victoria, 14 (1916), No. 3, pp. 168, 169, fig. 1*).—This article gives the results of some experiments with wheat suggested by work conducted at Rutherglen, Victoria, and previously noted (E. S. R., 36, p. 440). The experiments were planned to obtain further evidence upon the variations in the fertility and vigor of individual grains from different parts of the wheat spike. It was found that germination was most rapid in the grains of the sixth row from the top and that the average rate of germination decreased toward the base and apex of the head.

An effective head thrasher, W. E. Hanger (*Jour. Amer. Soc. Agron., 8 (1916), No. 4, pp. 267, 268, pl. 1, fig. 1*).—A head thrasher, constructed at the Maryland Experiment Station, to be used in thrashing wheat or oats in variety tests is described.

Agricultural seed.—Concerning weeds and weed seeds, G. P. Burns and A. K. Peitersen (*Vermont Sta. Bul. 200 (1916), pp. 3–79, figs. 52*).—Pages 5–60 of this bulletin include a discussion of the Vermont seed inspection law and a report of the results of the 1916 seed inspection. Pages 60–69 contain a discussion of weeds, their nature and control, together with illustrations and brief descriptions of 52 weeds commonly found in agricultural seed.

The use of sulphuric acid in combating weeds infesting wheat, A. Morettini (*Staz. Sper. Agr. Ital., 48 (1915), No. 10–11, pp. 693–716*).—According to the results of experiments here reported, the use of sulphuric acid at a strength of 66° B. in a solution of 10 per cent by volume and at the rate of 1,000 liters per hectare (about 107 gal. per acre), was of medium efficiency in combating

the greater portion of the weeds infesting wheat fields, but in most cases increased the yield sufficiently to compensate for the expense of the treatment. Where grain was sown in rows it was found better to hoe or cultivate, but where the crop was sown broadcast and the weeds were numerous the treatment with sulphuric acid solution was preferrable. The treatment was not useful when the dominant weed species belonged to the Gramineæ, Liliaceæ, or other families equally resistant to the action of dilute sulphuric acid.

It was not found that the sulphuric acid treatment is efficient in controlling foot rot of wheat.

Ferrous sulphate control of hedge mustard and wild mustard in Bavaria, 1904–1915, L. HILTNER (*Prakt. Bl. Pflanzenbau u. Schutz, n. ser., 14 (1916), No. 2, pp. 13–16, fig. 1*).—This article discusses the use in Bavaria of spraying machinery in the control of the wild mustards with ferrous sulphate.

Ragwort, P. M'GOVERN (*Dept. Agr. and Tech. Instr. Ireland Jour., 16 (1916), No. 3, pp. 411–417*).—This article deals with the life history and eradication of ragwort (*Senecio jacobæa*) in Ireland. This weed is described as a biennial, propagated only by seed.

HORTICULTURE.

What, where, when, and how to plant, E. E. BOHLENDER (*Tippecanoe City, Ohio: [Author], 1914, 2. ed., rev., pp. 36, figs. 74*).—A concise manual of information dealing with the culture of berry plants, roses, shrubs, evergreens, vines, and perennials.

Round the year in the garden, H. H. THOMAS (*London and New York: Cassell & Co., Ltd., 1916, pp. XII+275, pls. 76*).—A popular treatise on gardening dealing with the principal flowers, fruits, and vegetables of the various seasons and indicating the chief garden work to be done each month.

The home vegetable garden, C. W. WAID (*Mich. Agr. Col., Ext. Div. Bul. 4 (1916), pp. 35, figs. 10*).—A popular cultural treatise dealing with the farmer's garden, the suburban garden, and the city garden.

Growing seeds for the world, A. KRUHM (*Gard. Mag. [N. Y.], 24 (1916), No. 5, pp. 164–167, figs. 11*).—A popular historical account of the American garden seed industry.

Nitrate of soda spray for fruit bearing, W. H. VOLCH (*Pacific Rural Press, 93 (1917), No. 3, p. 72*).—Popular suggestions on the spraying of dormant fruit trees with nitrate of soda, based on investigations conducted by the author in cooperation with Ballard (E. S. R., 30, p. 640).

Results from spraying in Nova Scotia, G. E. SANDERS and W. H. BRITTAIN (*Canada Dept. Agr., Ent. Branch Circ. 7 (1916), pp. 11, pl. 1*).—In this circular the authors present some actual results obtained by owners spraying for profit in their own orchards in the Annapolis Valley, Nova Scotia. The data are discussed under the general headings of increase in quality of apples due to spraying, increase in quantity of apples due to continued spraying, economy in handling clean fruit, and profits in spraying.

The cost of spraying, F. I. ODELL (*Fruit Grower, 28 (1917), No. 1, pp. 3, 27, fig. 1*).—An analysis is given of spraying expenses in some apple orchards in southern Indiana, including tables showing the labor, materials, and cost for spraying one acre of a 30-year-old orchard in 1915, and the maintenance spraying expense for 20 acres for an 8-year period.

The apple as affected by varying degrees of dormant and seasonal pruning, W. H. ALDERMAN and E. C. AUCHTER (*West Virginia Sta. Bul. 158 (1916), pp. 3–56, figs. 22*).—A preliminary report of a pruning experiment covering a period of four years and embracing 366 apple trees of various ages. Study has been

made of the effects on vigor and fruitfulness of various degrees of dormant pruning, summer pruning at different times, and combinations of dormant and summer pruning. The work of other investigators is reviewed and a bibliography of related literature appended.

The results of the pruning work as a whole are in accord with those previously reported by the senior author (E. S. R., 35, p. 142). Although heavy annual dormant pruning has resulted in stronger terminal growth, the gain in total length of growth and in increase in trunk diameter has been less than with lightly pruned trees. Heavy dormant pruning appears to be primarily of value for developing a frame work during the first two or three years of the tree's life and for stimulating fruit production in middle-aged trees that are only in a fair state of vigor. As previously noted all classes of summer pruning have been inferior to dormant pruning.

The authors have also conducted experiments to determine the effects of ringing on the growth and fruitfulness of apple trees. Ringing of trees caused heavy crop production the season following the operation but so impaired the vigor that no crop was produced the second or third years, and at least three seasons were required to restore the tree to normal conditions.

Apples: Production estimates and important commercial districts and varieties, H. P. Gould and F. Andrews (*U. S. Dept. Agr. Bul. 485 (1917), pp. 48, figs. 16*).—A statistical study of the apple industry of the United States containing estimates relative to the production and distribution of the principal varieties in the country as a whole and in the individual States, including also an outline of the distribution of the apple industry in each State and the varieties grown. Estimates are also given of the proportion of early and late apples produced in each State and of the annual production of apples as a whole in the United States from 1890 to 1916, inclusive. A portion of the data have been previously noted (E. S. R., 32, p. 438).

Preliminary observations on the ripening of Bartlett pears, W. V. Cruess and P. M. Stone (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 12, pp. 425-429*).—Data are given on some preliminary tests conducted at the California Experiment Station to ascertain whether the proper time for picking pears to be shipped may be determined by a simple chemical test. The results thus far secured indicate that a minimum size may be of more value than a chemical test in deciding the time of picking.

Navel persimmons, J. E. Coit (*Cal. Citrogr., 2 (1916), No. 3, p. 9, fig. 1*).—Some Japanese persimmons observed in California that have a small secondary fruit included within the primary fruit are here illustrated and described.

The common honeybee as an agent in prune pollination, A. H. Hendrickson (*California Sta. Bul. 274 (1916), pp. 127-132, figs. 2*).—During the past three years the station has been conducting pollination studies with plums and prunes in the Santa Clara Valley. This bulletin comprises a progress report on that part of the project dealing with the honeybee as a factor in prune pollination.

Because of the conflicting reports of the value of interplanting such varieties as the French prune and the Imperial prune, and also because of a noticeable lack of bees and other insects in the prune orchards of the valley during the blooming period, an experiment was planned in which a tent of white mosquito bar was placed over a pair of adjoining French and Imperial prune trees as nearly as possible of the same age and size. A hive of honeybees was kept in this tent throughout the blooming period. A similar tent inclosed a pair of French and Imperial prune trees, from which bees and other insects were excluded throughout the blooming period. Observations were made on the set of fruit under these tents and also on trees of these varieties exposed to normal conditions.

The honeybees seemed to prefer the flowers of the French prune and seemed to devote most of their attention to this variety. As a result, the French prune tree exposed to the bees set a much heavier crop than that of the best trees exposed to normal conditions, whereas the Imperial prune tree exposed to the bees set only a light crop of fruit. The French prune tree from which bees were excluded set only a very light crop and the Imperial prune tree only a few scattering fruits. The experiment is to be repeated to determine, if possible, why the Imperial prune did not respond to pollination by the bees.

The work thus far conducted indicates that the French prune at least may be aided in setting a satisfactory crop by the presence of a large number of bees in the orchard during the blooming period.

Inheritance in Vitis, RASMUSON (*Mitt. K. Biol. Anst. Land u. Forstw., No 15 (1914), pp. 29–34, figs. 4*).—Data are given on character transmission in crosses between a number of selected phylloxera-resistant direct-bearing grapes and grafting stocks.

The results in general show that the trend of variation for some characters at least is the same for crosses between species as between varieties of the same species. Crosses between phylloxera-susceptible species yielded phylloxera-susceptible offspring. Crosses between phylloxera-resistant species gave both susceptible and resistant offspring, with the latter dominant. Immunity to phylloxera was also dominant and susceptibility recessive in the progeny of crosses between susceptible and resistant species.

Portuguese varieties of vines, F. DE CASTELLA (*Jour. Dept. Agr. Victoria, 14 (1916), Nos. 7, pp. 398–408; 9, pp. 565–570; 10, pp. 622–628; 11, pp. 673–686; 12, pp. 731–740, figs. 22*).—A descriptive account of the varieties of grapes grown in Portugal for the production of port wine.

Arsenate of lead in viticulture, C. F. MUTTELET (*Ann. Falsif., 9 (1916), No. 94–95, pp. 298–301*).—Analyses were made to determine the amounts of lead, copper, and arsenic in the wines, lees, and marcs of grapes sprayed with arsenate of lead after the formation of seeds.

The wines contained only very slight traces of copper and arsenic and no lead. The lees contained per liter 500 mg. (3.5 grains per lb.) of lead, 10 mg. of arsenic, and traces of copper. The marc contained per kilogram of dried product 200 mg. (1.4 grains per pound) of lead, 0.1 mg. of arsenic, and traces of copper. These results indicate that the consumption of wine before the lees are deposited may be dangerous and that the marc should not be fed to stock. Generally speaking, however, the use of arsenical sprays after the seeds are formed does not introduce toxic metals into products of consumption that are prepared with care.

Varietal standardization, L. B. SCOTT (*Cal. Citrogr., 2 (1916), No. 3, pp. 8, 9, fig. 1*).—In this paper the author points out the need of varietal standardization for the greater development of our subtropical fruit industries, special attention being given to the citrus fruits, avocado, and olive.

Four years' experience with budded avocado trees, J. T. WHEDON (*Cal. Citrogr., 2 (1916), No. 3, p. 7*).—A brief summary of results secured in Orange County, Cal., with 342 avocado trees, including 29 different varieties.

[Cacao experiments, 1914–15], J. DE VERTEUIL (*Bul. Dept. Agr. Trinidad and Tobago, 15 (1916), No. 6, pp. 183–205, pls. 8*).—This report is supplementary to a previous report for 1914–15 (E. S. R., 36, p. 141), and gives the results of manurial and natural yield experiments with cacao on a number of additional estates in Trinidad and Tobago not previously mentioned.

Bud variation in lemons, A. D. SHAMEL (*Cal. Citrogr., 2 (1917), No. 4, pp. 6, 7, 16, figs. 3; Jour. Heredity, 8 (1917), No. 2, pp. 75–81, fig. 1*).—A paper on

this subject read before the American Genetic Association in New York City in December, 1916, in which the author points out that recent studies with lemons in California have shown bud variation to take place as in the earlier work with the Washington navel orange (E. S. R., 34, p. 639). The records and observations of the lemon studies are to be published at a later date. The desirability of further systematic investigations of bud variations in citrus fruits grown in other regions and in all other plants propagated vegetatively is pointed out.

Notes on oranges and lemons, H. J. Davies (*Dept. Land Rec. and Agr., United Prov. Agra and Oudh, Bul. 38 (1916), pp. 22*).—Cultural notes, with special reference to conditions in India, are given.

How to fertilize olive trees, A. Rolet (*Vie. Agr et Rurale, 6 (1916), No. 53, pp. 474–479, figs. 3*).—Suggestions on fertilizing olive trees, with fertilizer formulas recommended by different authorities, are presented.

Manganese as a cause of the depression of the assimilation of iron by pineapple plants, M. O. Johnson (*Jour. Indus. and Engin. Chem., 9 (1917), No. 1, pp. 47–49, fig. 1*).—A summarized account of experiments which will be given in fuller detail in a publication of the Hawaii Experiment Station.

In continuation of the investigations by Wilcox and Kelley (E. S. R., 27, p. 842), showing the detrimental effects of manganese in pineapple soils in Hawaii, the author finds that the manganese of the highly manganiferous soils of the island of Oahu is nearly, if not all, in the dioxid form, and that the toxic effect observed on pineapple plants is due to a depression in the assimilation of iron. Pineapple plants have recovered from the toxic effects of manganese when supplied with iron through the leaves by means of sprays. A commercially successful treatment has been worked out and the profitable utilization of these highly manganiferous soils seems assured.

Soil management in cinchona culture, P. van Leersum (*Grondbewerking bij de Kinacultuur. Surabaya, Java: Nederland.-Ind. Landb. Synd., 1916, pp. 13*).—A paper introducing themes for discussion at the Dutch India Soil Congress at Djokja, in October, 1916. Some comparative data are given showing the beneficial results of intensive culture in growing cinchona.

The cultivation of belladonna in California, A. Schneider (*California Sta. Bul. 275 (1916), pp. 135–160, figs. 12*).—This bulletin gives directions for growing belladonna based upon numerous field tests, many of which were on a commercial scale, conducted under the direction of the station. The California and other American cultural experiments with belladonna are summarized and the plant is considered with reference to climatic and soil requirements, seed germination and care of the seedlings, transplanting seedlings and crown cuttings, care of the crop, harvesting, preparation for market, yields, and field enemies of belladonna. Data are also given relative to the alkaloidal yield of belladonna of different ages, together with suggestions for increasing the alkaloidal contents of the plants.

Possibility of the commercial production of lemon-grass oil in the United States, S. C. Hood (*U. S. Dept. Agr. Bul. 442 (1917), pp. 12, figs. 3*).—This bulletin combines directions for growing lemon grass (*Cymbopogon citratus*) and the production of oil with the results of experiments conducted by the Bureau of Plant Industry in central Florida during the past eight years in which field tests were made with 13 varieties secured from 8 different parts of the world.

Consideration is given to the soil and climatic requirements of lemon grass, propagation, fertilizers and cultivation, harvesting, distillation, varieties, factors affecting the yield and citral content of lemon-grass oil, solubility of lemongrass oil in alcohol, and commercial possibilities. The experiments as a whole indicate that the production of lemon-grass oil would not be profitable if all

overhead charges for the distillation plant were placed against this crop alone. It is believed, however, that if grown in connection with other volatile oil plants, thus prolonging the distilling season, this crop will yield returns comparing favorably with other crops grown on the same type of land.

What science has done and will do for floriculture, E. A. WHITE (*Gard. Chron. Amer., 21 (1917), No. 1, pp. 11–14*).—An abstract of a lecture in which the author reviews some of the scientific contributions to the development of ornamental plant production.

FORESTRY.

Eighth annual report of the state forester.—Forestry in Vermont, A. F. HAWES (*Ann. Rpt. State Forester Vt., 8 (1916), pp. 43, pls. 3*).—This report outlines forest planting operations in the State and gives an account of activities at the state nurseries and on the various state forests, including data on the white pine blister rust inspection for 1916 and a financial statement for the year. A report on forest fires for 1915 by R. M. Ross and a note by B. A. Chandler on the assistance rendered to private owners in the close utilization of forests are also included.

Progress report of the Forest Research Institute for the year 1915–16, B. B. OSMASTON (*Rpt. Forest Research Inst. [Dehra Dun], 1915–16, pp. 21*).—A brief progress report of the investigation and research work of the institute dealing with silviculture and working plans and with forest botany, economy, zoology, and chemistry. Lists of forest publications issued since the establishment of the Forest Research Institute are appended.

The trees of Vermont, G. P. BURNS and C. H. OTIS (*Vermont Sta. Bul. 194 (1916), pp. 3–244, pls. 9, figs. 507*).—A classification with popular descriptions of the trees of Vermont, and comprising a revision of Bulletin 73 of the Vermont Station (E. S. R., 12, p. 153) in which considerable material published by Otis elsewhere (E. S. R., 29, p. 43) has been adapted in somewhat revised form to Vermont conditions. The bulletin is intended primarily for the use of pupils in public schools and of persons not especially trained in botany.

The vegetation of the New Jersey pine barrens, J. W. HARSHBERGER (*Philadelphia: Christopher Sower Co., 1916, pp. XI+329 pls. 2, figs. 283*).—A descriptive account of the pine-barren vegetation of the coastal plain of New Jersey from the phytogeographic and ecologic aspects. The subject matter is based upon observations and research work which have been in progress for a period of at least 25 years.

The sandalwoods of Hawaii.—A revision of the Hawaiian species of the genus Santalum, J. F. ROCK (*Bd. Comrs. Agr. and Forestry Hawaii, Bot. Bul. 3 (1916), pp. 43, figs. 13*).—A key with botanical descriptions is given of nine species and two varieties of sandalwood, native to Hawaii.

The conifers and taxads of Japan, E. H. WILSON (*Pubs. Arnold Arboretum No. 8 (1916), pp. XI+91, pls. 59*).—A descriptive account with illustrations and a full synonymy of different species and varieties of the conifers and taxads of Japan, including references to the principal literature on the subject.

Indian timbers used in engineering construction, R. S. PEARSON (*Trans. Internat. Engin. Cong., 1915, Materials for Engin. Construct., pp. 15*).—A paper presented at the International Engineering Congress at San Francisco in September, 1915. It briefly describes the principal timber species of India with reference to their distribution, growth, physical and mechanical properties, uses, yield, and prices; summarizes what is being done to maintain the supply of timber; and reviews the economic position of the timber trade in India.

Experimental notes on the bitter oak, E. FERRARI (*Bol. Quind. Soc. Agr. Ital., 21 (1916), No. 24, pp. 678–681*).—The author calls attention to the importance of securing data on the growth of Italian trees, and presents diameter, height, and volume measurements of 22 bitter oak trees ranging in age from 39 to 97 years.

Gutta-percha, B. H. F. BARNARD (*Agr. Bul. Fed. Malay States, 5 (1916), No. 2, pp. 25–37*).—An account of gutta-percha-yielding trees with reference to their botany, general distribution, and distribution in the Federated Malay States, including also considerations relative to methods of extracting gutta-percha, yield, cost of tapping, cultivation, improvement of natural gutta-percha forests, and pests. Tabular data are given showing the yield of clean gutta from a number of trees that have been tapped four times during the period 1909 to 1915.

DISEASES OF PLANTS.

Laboratory outlines in plant pathology, H. H. WHETZEL, L. R. HESLER, C. T. GREGORY, and W. H. RANKIN (*Ithaca, N. Y.: Authors, 1916, pp. 207*).—The outlines given are those used at Cornell University, no attempt having been made to adapt them for use at other institutions. Instructors are expected to select materials suitable for their courses. The sequence of procedure is essentially the same in all exercises, and its mastery should result in the student's acquiring habits of orderly and logical investigation. The authors express the hope that the grouping of the diseases studied will direct attention from the dominance of systematic mycology and turn it to the more logical classification and study of plant diseases based on pathological phenomena.

Diseases of cultivated plants and trees, G. MASSEE (*New York: The Macmillan Co., 1915, 2. ed., pp. XII+602+16, figs. 173*).—The new matter contained in this book is embraced in a supplement to the original edition (E. S. R., 24, p. 44). Descriptions are given of 20 or more diseases that have made their appearance or assumed economic importance since the earlier publication.

Report of committee on fungus diseases, T. F. MANNS (*Trans. Peninsula Hort. Soc. [Del.], 28 (1915), pp. 52–63*).—This is a condensed account of insect injury during 1914, also of plant diseases and of measures for their control, including a plant disease survey, the results of which are discussed.

Report of committee on fungus diseases, T. F. MANNS (*Trans. Peninsula Hort. Soc. [Del.], 29 (1916), pp. 58–64*).—Like the above report for the previous year, this deals partly with the prevalence, progress, and control of plant diseases in other sections of the country, but more particularly with diseases and contributing or opposing factors and results in and near Delaware. Some prevalent diseases of the season are briefly reported on in connection with the plants affected thereby.

Cooperation in the investigation and control of plant diseases, K. F. KELLERMAN (*Abs. in Mem. N. Y. Bot. Gard., 6 (1916), p. 517*).—This is an argument for closer cooperation between specialists studying plant diseases, on the one hand, and Federal, State, and local officials on the other, in order to secure quicker diffusion of knowledge regarding plant diseases and earlier and more effective employment of agencies for their prevention or control.

[Plant diseases in Barbados], J. R. BOVELL and J. S. DASH (*Rpt. Dept. Agr. Barbados, 1914–15, pp. 20–25, 43, 44*).—This portion of the annual report includes, among other data presented and discussed, a tabular account of the proportion of disease in the cotton hybrids under cultivation during 1910 to 1915 and a similar account of the prevalence of fungus diseases in cotton from the

experimental plats at Summervale during the seasons 1913–14 and 1914–15. Descriptive and other data regarding the cotton varieties employed are included.

The root disease of sugar cane, due to *Marasmius sacchari*, was noted on one estate in 1914, but the use of resistant varieties has in recent years helped to lessen the amount of trouble from this source. *Thielaviopsis paradoxa* (*T. ethaceticus*) was troublesome on some estates, experiment proving the necessity of properly making up the Bordeaux mixture for use in this connection. *Colletotrichum falcatum* was not severe during the season.

Late cottons were badly affected with black arm, angular leaf spot, and bacterial boll disease, all due to *Bacterium malvacearum*. Losses from anthracnose (*Glomerella gossypii*) were comparatively slight.

The Glœosporium dieback of cassava was again prevalent in some districts, and some plants at Codrington suffered considerably from a bacterial leaf disease. Yams were affected by a blackening fungus on the stems and leaves, the spore measurements of which agree closely with those of *G. pestis*.

Grapes affected with anthracnose (*G. ampelophagum*) were noted, the stems also being attacked. Leaves of grape growing in an unsuitable situation showed the presence of vine rust (*Uredo vitis*), also of a species of Cercospora, possibly *C. viticola*.

Young mango trees were attacked by *G. mangiferæ*, which blackened the shoots and portions of the young stems. Sorghum leaves showing rust were found to bear *Puccinia purpurea* and the rust parasite *Darluca filum*. A leaf spot associated with *Glœosporium* sp. was observed to cause considerable injury to *Pithecolobium unguis-cati*. Some palms of the genus Phœnix were found to be affected with *Graphiola phœnicis*.

Annual report for 1915 of the botanist, R. H. Biffen (*Jour. Roy. Agr. Soc. England, 76 (1915), pp. 309–313*).—This report deals with tests of seeds; identification of weeds, grasses, and cereals; rapelike sports among swedes and cryptogamic plant diseases, these last including potato-leaf curl and tuber wet rot; a rust and a bacterial disease of mangold; club root of swedes and cabbage; mildew in oats, vegetable marrow, and parsnips; blindness in barley and wheat; wheat bunt; alfalfa sickness; mildew on apple, peach, and gooseberry; pear scab; apple canker; plum silver leaf; Botrytis on lettuce; and minor diseases of ornamental plants.

Leptosphæria culmifraga is claimed to produce brittleness of wheat stems near the ground level. *Sporidesmium solani varians* appears to be somewhat common, causing a leaf spot of early potatoes, but to be controllable by the timely use of Bordeaux mixture.

Hydrogen ion concentration and natural immunity in plants, R. J. Wagner (*Centbl. Bakt.* [*etc.*], *2. Abt., 44 (1916), No. 24–25, pp. 708–719, figs. 7*).—A preliminary account is given of studies with *Sinapis alba*, *Brassica oleifera*, *Sempervivum hausmannii*, and *Solanum tuberosum*.

It is stated that the variation of hydrogen ion concentration in plant tissues is a phenomenon of reaction to the injection of pathogenic bacteria. The course and end results are related to the susceptibility of the plant in question and to the character of the disease as acute or chronic.

Crown gall or plant cancer, C. O. Smith (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 6, pp. 201–211, figs. 3*).—This is a somewhat general discussion of the now almost world-wide crown gall organism, *Bacterium tumefaciens*, and its degree of attack and other relations to the large number of plants which it can infect either naturally or artificially.

It is believed that the soils of California are often naturally infected with the crown gall organism, especially in case of those that were formerly wooded

or used for the growing of stone fruits. The organism is thought to be entirely a wound parasite.

Resistant stock is regarded as the most hopeful means of control, several varieties of plum being on trial in this connection. Rigid inspection before planting in the fall and again after the active spring growth sets in is regarded as very important. Tree surgery is considered as on the whole so uncertain and unsatisfactory as to be impracticable.

North American species of Allodus, C. R. Orton (*Mem. N. Y. Bot. Gard., 6 (1916), pp. 173–208*).—This account deals with the genetic and host relationships, life history, and classification of the genus Allodus, the hosts of which are said to number seven monocotyledonous and 40 dicotyledonous species distributed among 21 families representing 14 orders.

Some species of Nummularia common in Indiana, C. E. O'Neal (*Proc. Ind. Acad. Sci., 1914, pp. 235–249, figs. 15*).—Results are given of the examination of five species of Nummularia found at points in Indiana and elsewhere, only one of these, *N. discreta*, being regarded as of much economic importance.

The genus Rosellinia in Indiana, G. B. Ramsey (*Proc. Ind. Acad. Sci., 1914, pp. 251–265, figs. 9*).—A brief account is included of eight species of Rosellinia said to be destructive to living plants mentioned in this connection.

Correlation of certain long-cycled and short-cycled rusts, H. C. Travelbee (*Proc. Ind. Acad. Sci., 1914, pp. 231–234*).—The author has made a study of several species of Puccinia and furnishes a short list of combinations which are regarded as good correlations. It is thought that the possibilities of correlation studies are very numerous and that the practical application of the knowledge so gained will be made along the lines of culture work, especially in forecasting the alternate host plants of unconnected æcial or telial forms.

Continuous rust propagation without sexual reproduction, C. A. Ludwig (*Proc. Ind. Acad. Sci., 1914, pp. 219–230*).—The author, presenting data obtained largely from contributions of other investigators, concludes that a good many rusts can pass the winter and propagate themselves for a long time, if not indefinitely, maintaining a high degree of vigor without employing the sexual mode of reproduction.

Cereal diseases and pests, E. Riehm (*Centbl. Bakt.* [*etc.*], *2. Abt., 44 (1915), No. 14–16, pp. 385–407*).—This is a review of contributions by various authors during 1914 regarding injuries done to cereal crops by animal and vegetable parasites and by agencies not parasitic in character, about 124 titles being listed.

Cereal rusts in subtropical South America, G. Gassner (*Centbl. Bakt.* [*etc.*], *2. Abt., 44 (1916), No. 9–13, pp. 305–381*).—This is a study of the more common rusts affecting economic grains in the La Plata region at ten developmental stages of the plants, as carried out at periods during 1907 to 1910. The account includes also a discussion of climatic conditions in this region, the observed forms and specializations of the rusts, and their relations to particular varieties of the different grains.

The dependence of cereal rusts upon the development stage of the host plant and upon external factors, G. Gassner (*Centbl. Bakt.* [*etc.*], *2. Abt., 44 (1915), No. 17–23, pp. 512–617*).—This is a further report on the study above noted. It deals in considerable detail with the direct and indirect influence of climate, soil, and other factors as related to rust attack, and with the significance in this connection of developmental stages of different portions of the plants.

Oat smut in Indiana, F. J. Pipal (*Proc. Ind. Acad. Sci., 1914, pp. 191–196*).—While oat plants from fields of different counties in Indiana, sown with seed that had not been treated, showed proportions ranging from 11 to over 20 per cent of smut infection, the proportion was reduced to an average of about 0.3 per cent

by the use of the formaldehyde treatment, which is shown to be both simple and inexpensive. One pint of formaldehyde is added to 50 gal. of water, and the seed are thoroughly moistened by constant stirring, spread out to dry, and sown as soon as they will run through the drill, or dried more thoroughly if sowing is to be postponed.

Leaf smut of timothy, G. A. Osner (*New York Cornell Sta. Bul. 381 (1916), pp. 187–230 pl. 1, figs. 14*).—The leaf smut of timothy due to *Ustilago striæformis*, which also occurs on a large number of other grasses, is described. This fungus is of economic importance through its reduction of the yield of hay and of seed. The symptoms of the disease, its etiology, and pathology are described, after which an account is given of the effect of seed treatment by means of formaldehyde, hot water, and copper sulphate solutions. The results, while not conclusive, are considered to point strongly to the probability that the disease may be controlled by treating the seed with hot water.

A bibliography is appended.

Plant diseases affecting alfalfa, L. E. Melchers (*Quart. Rpt. Kans. Bd. Agr., 35 (1916), No. 138, pp. 339–353, figs. 19*).—Brief popular accounts are given of a number of diseases occurring on alfalfa in Kansas, the diseases being grouped according to their causes as parasitic or nonparasitic. In the first group the author describes dodder, leaf rust, leaf spots, bacterial stem blight, violet root rot, downy mildew, and a Phoma stem disease. In the second group accounts are given of a stem-cracking disease and yellow top of alfalfa.

In addition to the diseases enumerated, brief accounts are given of brown root rot, crown wart, and root knot, parasitic diseases which are not yet known to occur in the State.

Alfalfa crown wart in the western United States, R. McKee (*Jour. Amer. Soc. Agron., 8 (1916), No. 4, pp. 244–246*).—Discussing the life history and distribution of *Urophlyctis alfalfæ*, the author states that the question whether or not this fungus is endemic in the western United States has not yet been settled. Alfalfa plants grown in 1910 from seed imported from Peru, where the disease is known to exist, had considerable crown wart in 1914. Plants, apparently healthy, of *Medicago falcata*, originating at Highmore, S. Dak., and grown in 1914 and 1915 on ground that had never before grown alfalfa, showed a few well-developed galls of the crown wart. In this case it is thought that the farm implements may have carried the infection from other plants at the station.

Observations made in the Sacramento Valley are considered to show that the crown wart decreases the yield of hay and shortens the life of the plants. It occurs on light, sandy, and peat soils almost or quite as abundantly as on heavier soils, but is more abundant on overflowed than on higher lands. In this region the fungus is in its active stage of growth during the latter part of winter, spring, and early summer, the galls drying and disintegrating early in July. The disease is thought to be more abundant and widespread in the western United States than is commonly supposed.

A new disease of beets in northern France, E. Miège (*Vie Agr. et Rurale, 5 (1915), No. 19, p. 341, fig. 1*).—A description is given of a beet disease which appeared in 1915 in northern France. It is characterized by orange-colored spots, irregular swellings, and distortion of the foliage. The old leaves are the first to show alteration, which is associated with more or less retardation and abnormality of development in other parts of the plant. The trouble is thought to be due to physiological causes.

Is cucumber mosaic carried by seed? J. A. McClintock (*Science, n. ser., 44 (1916), No. 1144, pp. 786, 787*).—The author presents evidence which seems to show that the cucumber mosaic, or white pickle, disease is carried by seed.

Peanut mosaic, J. A. McClintock (*Science, n. ser., 45 (1917), No. 1150, pp. 47, 48*).—The author reports having observed in a peanut field a plant one shoot of which bore mottled leaves. This plant was transferred to a greenhouse, and at the same time mature pods from it were planted to determine whether the mosaic would be transmitted, but thus far there is no indication that the trouble is carried by the seed. Attempts to produce mosaic by inoculation, as well as other tests to determine its infectious nature, have given negative results.

Fungus parasites of the pigeon pea, E. Rangel (*Lavoura; Bol. Soc. Nac. Agr. [Brazil], 18 (1914), No. 1–4, pp. 5–18, pls. 3*).—This information, which has been noted previously from another source (E. S. R., 34, p. 52), is here given in both Portuguese and French.

A contribution to our knowledge of silver scurf (Spondylocladium atrovirens) of the white potato, J. J. Taubenhaus (*Mem. N. Y. Bot. Gard., 6 (1916), pp. 549–560, pls. 3*).—It is claimed that *S. atrovirens*, which is carried by seed or soil, is the cause of the disease of white potato known as silver scurf. This fungus is not causally connected with *Phellomyces sclerotiophorus*, which appears to be a saprophyte or very weak parasite. It is stated that the genus Phellomyces is not valid, the fungus really belonging to Colletotrichum, and *P. sclerotiophorus* being identical with *C. solanicolum* and *Vermicularia atramentaria*. It has accordingly been designated as *C. atramentarium*.

The sweet potato "soil rot" or "pox," a slime mold disease, J. A. Elliott (*Delaware Sta. Bul. 114 (1916), pp. 2–25, figs. 22*).—For several years work has been in progress on the cause and means of control of a disease of sweet potato known as soil rot or pox. The author, in the present publication, gives an account of laboratory studies and field observations of this disease, which he reports is due to a slime mold and not to *Acrocystis batatæ*, as previously claimed (E. S. R., 2, p. 416). The organism causing the disease is described under the name *Cystospora batata* n. g. and sp., and its life history and cytology are reported at length.

The sweet potato "soil rot" or "pox" organism, J. A. Elliott (*Science, n. ser., 44 (1916), No. 1142, pp. 709, 710*).—A preliminary account is given of the sweet potato soil rot or pox (see above).

Tree wounds and diseases, their prevention and treatment, A. D. Webster (*London: Williams & Norgate, 1916, pp. XX+215, pls. 32, figs. 9*).—This book deals in a general way with the treatment of tree wounds and diseases, the information being based on the author's practical work and observation. The author discusses the management of decaying trees, treatment of hollow trunks, supporting heavy and diseased branches, treatment of injuries from various causes, such as the adverse influence of soil or atmosphere, fungi, insects, etc., the prevention of diseases, and accidents and diseases to which trees are liable, A special chapter is given on fruit trees and their enemies.

Sun scald of fruit trees, a type of winter injury, A. J. Mix (*New York Cornell Sta. Bul. 382 (1916), pp. 235–284, pls. 2, figs. 2*).—A description is given of the winter injury to fruit trees commonly known as sun scald, in which the sun-exposed side of the trunk is affected. Two other types of injury somewhat related to sun scald are crotch injury and crown injury, or crown rot, both of which are discussed in connection with sun scald. In the author's experiments, artificial freezing and thawing at various temperatures were resorted to, their effect on the cambium being noted.

Sun scald injury is considered due to direct freezing to death of tissues through an increased tenderness of the tissue on the sunny side of the trunk in late winter or through a rapid temperature fall which causes the killing of the tissues on the sunny side of the tree at a higher temperature. Both of these

factors may be concerned in the injury. Sun scald is considered to be a late winter injury, as distinguished from crown rot, which is perhaps an early winter injury. Sun scald is, therefore, not induced by late growth or an unripened condition of the tree in the fall, while crown rot is undoubtedly due to this condition.

As a result of experiments, the author claims that a practical method of controlling sun scald is to spray or paint the trunks of the trees with whitewash in the fall or early winter. This method is considered more feasible than shading with boards or otherwise.

Control of pear scab, R. E. Smith (*California Sta. Circ. 157 (1916), pp. 4, figs. 5*).—Suggestions are given for the control of pear scab, plowing under of the dead leaves and two sprayings with Bordeaux mixture as the buds are unfolding being recommended. As an extra precaution a third spraying, with Bordeaux mixture to which lead arsenate has been added for codling moth control, may be given.

Peach scab and its control, G. W. Keitt (*U. S. Dept. Agr. Bul. 395 (1917), pp. 66, pls. 6, figs. 6*).—The results of laboratory and field investigations on peach scab, due to *Cladosporium carpophilum*, and its control are given. Peach scab is said to occur in practically every important peach-growing district in the United States east of the Rocky Mountains, and its presence has also been recorded in Canada, Europe, Australia, and South Africa. The characteristics of the disease are given, and the life history of the organism is described.

Inoculation experiments with single spore strains of the fungus from the fruit of the peach and from twigs and leaves gave typical infections in every case, with the exception of the leaf strain inoculated upon the fruit. Scab infection naturally appears shortly prior to the ripening period of the earlier varieties and may continue throughout the season. Primary infection is said to be produced by conidia from overwintered twig lesions. The fungus overwinters in the mycelial stage on living twigs and no evidence has been found of any other type of overwintering that is of practical importance in the life history of the parasite, although it has been shown that the mycelium may survive the winter on fallen fruit and twigs. The varying resistance of different varieties of peaches to scab is pointed out, and as a result of the experiments of the author and others, it is claimed that it may be satisfactorily controlled by spraying with self-boiled lime-sulphur or with finely divided wettable sulphur.

Grape anthracnose in America, C. L. Shear (*Off. Rpt. Sess. Internat. Cong. Vit., 1915, pp. 111–117, figs. 4*).—The author states that while grape anthracnose due to *Sphaceloma ampelinum* has apparently not been found on wild grapevines native to this country, it is known to attack varieties derived from our native species. A resemblance noted between the anthracnose fungus of the grape and that of some species of Rubus has suggested the possibility of a close relation or identity of the causal organisms, which is to be investigated.

The unpleasant features of the iron sulphate and sulphuric acid treatment are said to be obviated by the use of the effective combined lime-sulphur and Bordeaux mixture treatment which has been worked out by Hawkins (E. S. R., 28, p. 649). This proved to be successful when used in connection with removal of diseased material.

Studies on Plasmopara viticola (downy mildew of grapes), C. T. Gregory (*Off. Rpt. Sess. Internat. Cong. Vit., 1915, pp. 126–150, figs. 37*).—This is an account of studies by the author and by others on the various phases of development of *P. viticola*, including the pathological histology and physiology and circumstances determining resistance or susceptibility to downy mildew.

Downy mildew on direct bearers, S. OBIEDOFF, J. BAQUERO, and D. V. PEHLIVANOGLOU (*Ann. École Nat. Agr. Montpellier, n. ser., 14 (1915), No. 4, pp. 282–322, figs. 2*).—The authors have made very extensive observations regarding the degree of mildew attack on direct bearer vines of several species and numerous varieties in the collection of the School of Agriculture at Montpellier. The results are tabulated and discussed at greater length than in the account previously noted (E. S. R., 35, p. 352). It is admitted that no ideal direct producer uniting the comparatively high but not complete resistance shown by American vines with the flavor of product and adaptability characterizing French vines has been found to exist in that collection.

Variations in the resistance of grape to downy mildew, L. RAVAZ and S. OBIEDOFF (*Ann. École Nat. Agr. Montpellier, n. ser., 14 (1915), No. 4, Prog. Agr. et Vit. (Ed. l'Est-Centre), 37 (1916), No. 19, pp. 441–447, figs. 6, pp. 255–263, figs. 6*).—Having observed a more marked attack on grape blooms than on peduncles, the authors made a study of the numbers of stomata, supposedly the only points of invasion by the fungus.

The stomata were found to be more numerous in the case of the more resistant American vines. Stomatal numbers are considered to be unimportant as a factor determining susceptibility to mildew attack, which appears to depend upon conditions within the tissues themselves.

Powdery mildew of grapes and its control in the United States, D. REDDICK and F. E. GLADWIN (*Off. Rpt. Sess. Internat. Cong. Vit., 1915, pp. 117–125*).—This paper relates mainly to experience during 1911 to 1914 with fungicides differing in form, composition, and mode of application in the grape belt in Chautauqua County, N. Y. The tests with powdered sulphur yielded results which were inconclusive, necessitating their repetition with modifications.

Leaf spots on vines, W. H. DOBSON (*Gard. Chron., 3. ser., 59 (1916), No. 1534, p. 267*).—Discussing in a preliminary note the work of previous experimenters in connection with his own recent work on leaf spot of grapevines, the author concludes that boron in the soil is probably the cause of the disease.

Chlorosis of pineapples induced by manganese and carbonate of lime, P. L. GILE (*Science, n. ser., 44 (1916), No. 1146, pp. 855–857*).—Attention is called to experiments carried out by M. O. Johnson, of the Hawaii Experiment Station, for the control of chlorosis of pineapples on highly manganiferous soils by spraying the leaves with ferrous sulphate. The author points out differences between this form of chlorosis and that described by him in Porto Rico as induced by carbonate of lime (E. S. R., 26, p. 121). These differences lead him to believe that the manganese chlorosis may be due in part to a deficiency of iron in the plant caused by the action of manganese in the plant or in the soil, and in part to a direct toxic effect of manganese, while the lime-induced chlorosis is supposedly caused by a lack of iron in the plant due to carbonate of lime's diminishing the availability of iron in the soil. It is stated that these two kinds of chlorosis may be found essentially the same, except for certain secondary effects produced by an undue absorption of manganese.

The causes of unnecessary decay in lemons, R. L. WILLITS (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 6, pp. 213–216*).—This is a discussion of experiences in the growing, picking, and packing of lemons with reference to losses from diseases due to injury and from infection in the soil. Emphasis is placed on a strict organization of the work with a view to locating and minimizing injury to the fruit.

Overwintering of Oïdium parasitic on Photinia serrulata, V. PEGLION (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 25 (1916), I, No. 5, pp. 341, 342*).—A brief account is given of a fungus described in part which, in the conidial stage here noted as parasitic on *P. serrulata*, presents considerable

analogy with *O. farinosum.* The mycelium appears to winter in the host, adding another example of this adaptive device to those previously noted by others, more recently by Melhus (E. S. R., 34, p. 154).

An Oïdium mildew on carnations, W. B. Mercer (*Jour. Roy. Hort. Soc., 41 (1915), No. 2, pp. 227–229, fig. 1*).—A fungus noted in 1914 as causing a mildew on carnations and said to be a member of the Erysiphaceæ has not yet been fully identified.

A spray which is said to control the disease is made up for keeping in stock by mixing 1.75 lbs. of crystallized copper sulphate and 1 qt. of strong ammonia with 2.5 gal. of water. Before using, each pint of this is to be diluted with 8 gal. of water.

Lime-sulphur, though effective as a fungicide, injures the appearance of the plants.

The biology of Uredineæ on Geranium, Gina Jacob (*Centbl. Bakt.* [*etc.*], *2. Abt., 44 (1915), No. 17–23, pp. 617–658, figs. 7*).—Details of a study are given relating chiefly to the biology of the species of Puccinia and Uromyces on Geranium and Polygonum.

A new leaf spot of Viola cucullata, H. W. Anderson (*Proc. Ind. Acad. Sci., 1914, pp. 187–190*).—A preliminary report is made on a leaf spot of *V. cucullata* believed to be caused by a Colletotrichum, not previously noted in this connection, but probably identical with that occurring on *V. rotundifolia.*

The control of damping-off of coniferous seedlings, C. Hartley and R. G. Pierce (*U. S. Dept. Agr. Bul. 453 (1917), pp. 32, pls. 2, fig. 1*).—Accounts are given of experiments for the control of damping-off of coniferous seedlings due to various fungi, among them *Pythium debaryanum, Fusarium moniliforme,* and *Corticium vagum solani.*

Experiments for the control of loss due to damping-off are reported from a number of Forest Service nurseries and elsewhere, in which various methods of soil disinfection were tested. Of the many methods tested, treatments with sulphuric acid, copper sulphate, zinc chlorid, and formaldehyde have proved most satisfactory, but the different disinfectants behaved quite differently at different nurseries. On the whole, dilute sulphuric acid has given the best results. Heat disinfection has been only partially effective. In some soils formaldehyde was found to kill dormant seed, while the other chemicals mentioned caused in some nurseries the death of the root tips of the germinating seedlings. Sulphuric acid as a disinfectant has in some cases resulted in a marked increase in the late season growth of pine seedlings.

Parch blight on Douglas fir in the Pacific Northwest, T. T. Munger (*Plant World, 19 (1916), No. 2, pp. 46, 47*).—A description is given of an injury to the foliage of Douglas fir trees at points in Oregon and Washington. This appears serious in spring in case of isolated trees of all ages on the eastern edges of groves and is ascribed to exposure of these trees to the drying Chinook winds at the time of the year when they are least able to withstand the parching influence of these winds. The injury is most severe on the so-called coast form of the Douglas fir. No permanent effects of this scorching are noted other than perhaps certain deficiencies of development on the most exposed sides of the trees. This form of injury is said to be analogous to the winter injury of white pine in Maine, as described by Morse (E. S. R., 21, p. 144). Parch blight is suggested as an expressive and distinguishing name for this injury.

The alternate hosts of the white pine blister rust, L. R. Grose (*Amer. Forestry, 22 (1916), No. 272, pp. 469–471, figs. 18*).—Brief descriptions are given of the wild or cultivated currant and gooseberry, alternate hosts of the white pine blister rust. Species named as of particular importance in this connection

are *Ribes cynosbati*, *R. hirtellum* (or *R. oxyacanthoides*), *R. prostratum* (*R. glandulosum*), *R. americanum* (*R. floridum*), *R. triste*, *R. lacustre*, and *R. rotundifolium*. Maps are given to show the approximate range of each of these species in the Northeastern States and neighboring parts of Canada. Other native species are said to occur elsewhere, 70 out of a total of 120 species and subspecies being found in the United States, generally in the neighborhood of the five-leaved pines.

[The white pine blister rust situation], P. SPAULDING (*Amer. Forestry, 22* (*1916*), *Nos. 266, pp. 97, 98, fig. 1; 267, pp. 137, 138, fig. 1*).—This information has already been noted (E. S. R., 35, p. 551).

White pines of Lenox menaced (*Amer. Forestry, 22* (*1916*), *No. 272, pp. 472, 473, fig. 1*).—This is a brief account of the appearance, spread, and effects of blister rust among the noted white pines of Lenox, Mass., and of efforts now being made for control of the disease. In May and June of 1916 it was found to have attacked many white pines of all sizes and ages in this region, some trees having branches infected 60 or 70 ft. above the ground. Late in May the early summer stages of the blister rust appeared on currant and gooseberry leaves and the late summer form, which infects pine trees in the fall, was found late in June.

Conditions near Ipswich, Mass., have shown that there is no hope for the white pine trees that have been long exposed to the infecting spores from neighboring currant and gooseberry bushes.

Endothia parasitica and related species, C. L. SHEAR, N. E. STEVENS, and RUBY J. TILLER (*U. S. Dept. Agr. Bul. 380* (*1917*), *pp. 82, pls. 23, figs. 5*).—This bulletin gives an account of the taxonomy, morphology and development, and physiology of *E. parasitica*, the cause of the chestnut canker, and related species of the organism. To determine the specific identity of the organism, a study was made of all authentic specimens of all the species of Endothia obtainable.

According to the authors, the genus is divided into two sections based on the character of the ascospores. The first section contains two species, *E. gyrosa* and *E. singularis*, while the second section contains four species and one variety, *E. fluens*, *E. fluens mississippiensis*, *E. longirostris*, *E. tropicalis*, and *E. parasitica*. The host plants of the different species are mentioned, and *E. parasitica*, which is the only species thus far found to be actively parasitic, is reported to occur on Acer, Carya, Castanea, Quercus, and Rhus, but is known to be seriously parasitic only on Castanea. The oriental species of chestnut are said to be more or less resistant to the attack of this parasite.

A list of cited literature is appended.

Notes on some South African mistletoes and their hosts, R. MARLOTH and I. L. DREGE (*So. African Jour. Sci., 11* (*1915*), *No. 10, pp. 402, 403, pl. 1; abs. in Internat. Inst. Agr.* [*Rome*], *Internat. Rev. Sci. and Pract. Agr., 7* (*1916*), *No. 1, pp. 159, 160*).—The genus Viscum, comprising about 60 species in various parts of the world, is said to be represented in South Africa by about 12 species. Among those which inhabit several hosts are *V. capense*, the most widely distributed species, *V. rotundifolium*, *V. obscurum*, and *V. crassulæ*.

V. minimum has been found only on *Euphorbia polygona* and only near Port Elizabeth. This plant is described as mainly an internal parasite, analogous in some respects to the fungi *Plasmopara viticola* on grape and *Peronospora infestans* on potato. It is said to require about two years to produce its first flowers, the fruit being much larger than the remaining portion of the plant exposed to view.

Some studies on Bordeaux mixture, B. F. LUTMAN (*Vermont Sta. Bul. 196* (*1916*), *pp. 3–80, pls. 4, figs. 11*).—The author gives the results of extensive studies on the fungicidal and physiological relations of Bordeaux mixture,

together with statements regarding the physical and chemical properties of that fungicide, particularly its settling, aging, preservation, etc. Notes are given on the efficiency of Bordeaux powder and Bordeaux paste as compared with freshly made Bordeaux mixture. The action of the fungicide on spore germination and its physical effect on various host plants, especially on potatoes, are described at length. In the case of the potato plant, control of flea beetle injury and tipburn by means of Bordeaux mixture are considered of much importance. The author recognizes the effect of different climates on the action of Bordeaux mixture, which, in the open fields of this station, seemed to have a favorable physiological effect.

Summarizing his investigations, the author states that dilute solutions may be used at a considerable saving. Thorough and violent stirring is said to break up the colloidal membranes, causing the mixture to settle slowly. Sphere crystals are formed in a short time from the copper salts in ordinary mixtures, and their covering power and adhesiveness are much less than those of colloidal membranes. A small quantity of cane sugar or glucose tends to preserve indefinitely the physical and chemical character of the fungicide. The copper in the thinner membranes is said to be immediately soluble and fungicidal, while that in the portions adjacent to the lime particles gradually becomes soluble. The lime in the mixture is also claimed to be fungicidal.

The action of Bordeaux mixture on the fungus spores is said to result in the killing of the spores, the retardation of their germination, or the putting forth of a short germ tube that is not likely to grow. Bordeaux mixture is claimed to kill largely by contact, the drip water not being highly fungicidal. Under field conditions this fungicide increases transpiration in freshly sprayed plants and increases the size of the cells, the chromatophores, and the nuclei. In the greenhouse or in a climate where neither tipburn, flea beetle injury, nor early or late blights occur, Bordeaux mixture does not seem to be either beneficial or harmful, but is quite unnecessary.

A bibliography is appended.

ENTOMOLOGY.

Miscellaneous notes on injurious insects, P. J. PARROTT and H. E. HODGKISS (*New York State Sta. Bul. 423 (1916), pp. 359–387, pls. 8, figs. 4*).—These notes relate to the biology, economic importance, and treatment recommended for a number of fruit insects, which, though generally of minor importance, may become sufficiently numerous in occasional years to cause considerable damage, namely, the orchard ermine moths (*Yponomeuta malinellus* and *Y. padellus*), the peach leaf weevil (*Anametis granulata*), the lesser peach borer (*Synanthedon pictipes*), the lime-tree winter moth, the gooseberry fruit worm, and a green fruit worm on apple (*Graphiphora alia*).

The orchard ermine moths, an account of which by Parrott and Schoene has been previously noted (E. S. R., 28, p. 557), are being introduced into the State in large numbers by importations of foreign-grown nursery stock, their infestation being largely confined to apple seedlings. Observations of the mining of leaves and other larval activities on apple are noted.

The peach leaf weevil is reported to have been present in destructive numbers during two different years in plantings of young peach trees in Niagara County. The opening buds and margins of unfolding leaves were eaten by the weevil, which deposits its eggs in clusters of from 3 to 40 in concealed situations, such as the folded edges of partially-expanded leaves or in recesses caused by a leaf being folded upon itself. Unusual numbers of the larvæ of the

lesser peach borer were observed in 1907 and 1908 in one orchard of peach and plum trees at Bellona. The notes given relate to their attack, nature of the injury, and habits of the species.

The lime-tree winter moth, which persists from year to year unnoticed in woodlands, appeared in conspicuous numbers in 1912 in fruit plantings. The gooseberry fruit worm occasionally attacks currant plantations, effecting serious losses in fruit yields through tunneling of the berries by the larvæ, which draw together fruit clusters and leaves by means of silken threads. Spraying with arsenate of lead or Paris green as the earliest webs were forming gave a large measure of protection from damages by the larvæ. Specimens of a type of green fruit worm, common in one orchard, which were reared to maturity proved to be *G. alia*.

Some new or rare fruit pests, F. H. HALL (*New York State Sta. Bul. 423, popular ed. (1916), pp. 8, figs. 10*).—A popular edition of the bulletin above noted.

Potato insects, R. L. WEBSTER (*Iowa Sta. Bul. 155, popular ed. (1915), pp. 3–30, figs. 35*).—A popular edition of the bulletin previously noted (E .S. R., 33, p. 352).

The insect fauna of New Jersey greenhouses, exclusive of the Coccidæ, H. B. WEISS, (*Jour. N. Y. Ent. Soc., 24 (1916), No. 2, pp. 144–150*).—Forty-nine species, exclusive of the Coccidæ, are listed as occurring in greenhouses in New Jersey.

Cacao thrips and die-back in St. Vincent (*Agr. News [Barbados], 15 (1916), Nos. 369, pp. 206, 207; 370, pp. 222, 223*).—A brief report of observations of the cacao thrips, and die-bach of cacao made by the entomologist and mycologist in St. Vincent, who found that the conditions which are responsible for an outbreak of thrips in Grenada (E. S. R., 35, p. 357) have a similar effect in St. Vincent.

A synopsis of the genus Oxythrips, J. D. HOOD (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 4–6, pp. 37–44*).

A new Plectrothrips from Jamaica, J. D. HOOD (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 7–9, pp. 78–80, pl. 1*).

Check list of the Hemiptera (excepting the Aphididæ, Aleurodidæ, and Coccidæ) of America, north of Mexico, E. P. VAN DUZEE (*New York: N. Y. Ent. Soc., 1916, pp. XI+111; rev. in Psyche, 23 (1916), No. 4, pp. 128, 129; Ent. News., 27 (1916), No. 10, pp. 474, 475*).—This check list, based upon a complete bibliographical and synonymical catalogue of the Hemiptera of America north of Mexico now in manuscript form, includes the systematic arrangement, full synonymy, date of each name, and general distribution of each species in addition to the numbered list of forms. The list enumerates 699 genera and 2,969 species, the Heteroptera being 465 and 1,477, respectively, and the Homoptera, 234 and 1,492. A list is given in the preface of new names proposed.

The reviews are by H. M. Parshley and J. R. de la Torre Bueno, respectively.

Remarks on Lygus invitus, with descriptions of a new species and variety of Lygus, H. H. KNIGHT (*Canad. Ent., 48 (1916), No. 10, pp. 345–349, figs. 2*).—The author reports finding that *L. invitus* breeds only on the elm, preferring always the young thrifty plants with succulent shoots.

L. communis, here described as new to science and commonly known as the false tarnished plant bug, is a destructive enemy of the cultivated pear and is found commonly on *Cornus* spp. Life history studies of this pear pest under the name *L. invitus* by Parrott and Hodgkiss have been previously noted (E. S. R., 30, p. 358).

L. communis novascotiensis n. var., which breeds abundantly on apple in Nova Scotia, is also described.

The ash leaf bug, Neoborus amoenus, E. L. DICKERSON and H. B. WEISS (*Jour. N. Y. Ent. Soc., 24 (1916), No. 4, pp. 302–306, pl. 1*).—This consists of descriptions of the several stages of and biological notes on *N. amoenus*, which injures the foliage of ash trees and has a much wider distribution in New Jersey than previously recorded.

Notes on cicadas from the United States with descriptions of several new species, W. T. DAVIS (*Jour. N. Y. Ent. Soc., 24 (1916), No. 1, pp. 42–65, pls. 4, figs. 9*).—The author notes 15 species of which 6 are described as new to science.

The identity of Eriosoma querci, A. C. BAKER (*Ent. News, 27 (1916), No. 8, pp. 359–366, fig. 1*).—*Anoecia querci*, which occurs on Cornus, is shown to be the correct name for this aphidid. The species has been found to be distinct from the European *A. corni*.

Monarthropalpus buxi in New Jersey, H. B. WEISS (*Psyche, 23 (1916), No. 5, pp. 154–156, pl. 1*).—The European boxwood leaf miner is reported to occur in widely separated parts of New Jersey.

The susceptibility of the eggs of Aphis pomi and A. avenæ to hydrocyanic acid gas formation, W. A. ROSS (*Canad. Ent., 48 (1916), No. 11, p. 367*).—The author has found that when fumigated just before or shortly after the buds begin to swell the eggs of *A. pomi* and *A. avenæ*, as well as the San José scale, on young trees are destroyed by hydrocyanic acid gas, 1 oz. to 100 cu. ft. (1:1:3), when exposed for 45 minutes.

Notes on the Psammocharidæ described by Provancher, with description of a new species, S. A. ROHWER (*Canad. Ent., 48 (1916), No. 11, pp. 369–372*).—*Ceropales foxii* from Falls Church, Va., is described as new.

The shell-bark hickory mealy bug, A. H. HOLLINGER (*Canad. Ent., 48 (1916), No. 12, pp. 411–413*).—Under the name *Pseudococcus jessica* the author describes a mealy bug which occurs on hickory at Columbia, Mo.

Contributions to the knowledge of the Dactylopiinæ of Hawaii, E. M. EHRHORN (*Proc. Hawaii. Ent. Soc., 3 (1916), No. 3, pp. 231–247*).—In this paper the author adds five genera, of which two (Phyllococcus and Nesococcus) are new to science, and eight new species, making a total of 25 species of Dactylopiinæ for the Hawaiian Islands.

An investigation of the best methods of destroying lice and other body vermin, J. P. KINLOCH (*Brit. Med. Jour., No. 2892 (1916), pp. 789–792*).—In continuing investigations previously noted (E. S. R., 34, p. 356) the author's experiments have substantiated the report by Bacot (E. S. R., 36, p. 356) that lice do not survive immersion in boiling water.

"Several insecticidal powders have been tested, and of these N. C. I. powder [naphthalin, 96 per cent; creosote, 2 per cent, and iodoform, 2 per cent] is the most destructive to lice. Of the three constituents of N. C. I. powder, naphthalin and creosote have each a strong insecticidal action. The insecticidal action of iodoform is feeble. Naphthalin appears, so far as my comparative tests have gone, to be the most suitable basis for use in the preparation of a powder destructive to lice. Commercial naphthalin is more actively insecticidal than pure naphthalin, and it appears that the lethal power of naphthalin for lice is dependent in great part on the presence of hydrocarbons and coal-tar derivatives other than pure naphthalin. The immediate lethal effect of creosote when mixed with naphthalin is less than that of some other insecticidal liquids, but the longer period during which creosote continues to act more than compensates for the initial disadvantage. In addition to its feeble insecticidal activity, iodoform greatly increases the adhesiveness of N. C. I. powder for cloth. The inclusion of iodoform in the powder is accordingly justified, although similar adhesiveness of the powder is obtainable at less cost by substituting

the insecticidally inert but cheaper magnesium silicate for iodoform in the powder.

"The insecticidal power of naphthalin-creosote powders gradually diminishes when they are exposed in the open air. The moist nature of such powders precludes their being used successfully in perforated tins, and it has not been possible to dry the powders and at the same time retain the moist and volatile hydrocarbons and other coal-tar derivatives on which the insecticidal effect mainly depends."

Notes on Anoplura and Mallophaga, from mammals, with descriptions of four new species and a new variety of Anoplura, G. F. FERRIS (*Psyche, 23 (1916), No. 4, pp. 97–120, figs. 12*).—This paper is supplementary to that previously noted (E. S. R., 36, p. 253).

Notes on the feeding habits of adult Chrysopidæ, L. B. RIPLEY (*Ent. News, 28 (1917), No. 1, pp. 35–37*).—The author's observations of the feeding habits of adult Chrysopidæ have led him to conclude that (1) adults of both sexes feed upon smaller, soft-bodied insects, drink water, and discharge solid excrement; (2) unfed females die of starvation, leaving a large portion of their eggs unlaid; and (3) females on the point of starvation eat their own eggs, extracting them from the abdomen as frequently as they are available.

A new species of Exoprosopa, F. R. COLE (*Ent. News, 27 (1916), No. 10, p. 463, fig. 1*).

A new species of Tortrix of economic importance from Newfoundland, A. GIBSON (*Canad. Ent., 48 (1916), No. 11, pp. 373–375, pl. 1*).—Under the name *Tortrix oleraceana* the author describes a new lepidopteran, the larvæ of which in July, 1915, were very destructive to cabbage on farms near St. Johns, Newfoundland, and on one farm destroyed all of the first and much of the second plantings.

A caterpillar on the ears of wheat, W. SOMMERVILLE (*Jour. Bd. Agr. [London], 23 (1916), No. 3, pp. 263–238, fig. 1*).—The caterpillar of the rustic shoulder-knot moth (*Hadena basilinea*, also known as *Trachea* or *Apamea basilinea*) is said to have caused a considerable loss of wheat on experimental plats at Oxford.

Mosquitoes and man, A. H. JENNINGS (*Science, n. ser., 44 (1916), No. 1128, pp. 201–203*).—A discussion of a paper of the same title by C. S. Ludlow.[1]

New Aedes from the mountains of California, H. G. DYAR (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 7–9, pp. 80–90*).

The earliest name of the yellow fever mosquito, F. KNAB (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 4–6, pp. 59, 60*).

Eggs and oviposition in certain species of Mansonia, H. G. DYAR and F. KNAB (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 4–6, pp. 61–68, fig. 1*).—This paper includes a description of *Mansonia humeralis* n. sp. from British Guiana.

Mosquitoes at San Diego, California, H. G. DYAR (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 4–6, pp. 46–51*).

The March fly (Bibio abbreviatus) in grain fields and as a pest of celery, E. H. STRICKLAND (*Agr. Gaz. Canada, 3 (1916), No. 7, pp. 600–603, figs. 3*).—In the autumn of 1913 and of 1914 a large percentage of the celery plants grown at the Dominion Experimental Station at Lethbridge, Alberta, were found to have been damaged extensively by larvæ of *B. abbreviatus*. This appears, however, to be an exceptional feeding habit of these larvæ, which, for the most part, feed on decaying material.

In the fall of 1914, when the celery was dug it was found that the larvæ had eaten away the soft pulp between the fibro-vascular bundles of the stalks of

[1] Science, n. ser., 43 (1916), No. 1118, pp. 784, 785.

celery to an average depth of $\frac{1}{16}$ in. While the work of a single larva does not extend for more than about ¼ in. between two of the vascular ridges, a large number swarm around infested plants so that the whole of the portion of the plant below the ground, some 9 in. in length, may be affected. Rarely larvæ burrow deeply into the pulp, thus forming small tunnels. In a typically attacked plant five of the largest stalks were seriously damaged and three to a lesser extent, the central stems not being damaged.

The attacked areas turn brown during the late summer and autumn, and are the seat of infection for various fungus diseases and small dipterous larvæ, such as Drosophila, which soon render the plants unfit for the market. Since the damage is to a large extent incidental to the method of bleaching celery by bringing it into contact with larvæ-infested earth, it is recommended that in localities where these larvæ occur in large numbers the celery be bleached between boards or prepared paper.

What is Tabanus mexicanus? F. KNAB (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 7–9, pp. 95–100, fig. 1*).

Two new North American Diptera, R. C. SHANNON (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 4–6, pp. 69–72, fig. 1*).

Critical notes on Syrphidæ, F. KNAB (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 7–9, pp. 91–95*).

Further notes on Syrphidæ, F. KNAB (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 10–12, pp. 133–135*).

Notes concerning Gastrophilus hæmorrhoidalis, R. R. PARKER (*Jour. N. Y. Ent. Soc., 24 (1916), No. 4, pp. 253–255, fig. 1*).—Observations of the peculiar shape of the egg of the nose fly or red-tailed bot (*G. hæmorrhoidalis*) have led the author to suggest that the pain which results when the egg is thrust into the nose or lips of a horse may account for the nervous and sometimes uncontrollable fear shown by the horse when the flies are "striking."

Lithohypoderma, a new fossil genus of oestrids, C. H. T. TOWNSEND (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 10–12, pp. 128–130*).

Some notes concerning overwintering of the house fly, Musca domestica, at Dallas, Texas, W. E. DOVE (*Jour. Econ. Ent., 9 (1916), No. 6, pp. 528–538*).—The observations here reported, all of which were made at Dallas, Tex., have been summarized by the author as follows:

"Adult house flies having sufficient food, not subjected to fatal temperatures, killed by *Empusa muscæ*, nor destroyed by predators, show increased longevity in indirect proportion to decreases in temperature. The general tendency of adults to seek temperatures above 60° F. necessarily causes a shorter longevity than 91 days, which was obtained in a most favorable abnormal caged condition. The humidity being normal and adults being prevented from warmer temperatures, they become inactive at 45°, crawl slightly at 48°, and will voluntarily fly at 53°. Even previously fed adults, if subjected to freezing temperatures, die in less than three days. 'Northers,' causing sudden drops in temperature, are responsible for a large mortality of flies in the vicinity of Dallas, Tex., yet warm periods occur during midwinter which permit depositing.

"There is a possibility that epidemics of *E. muscæ* may be caused by a lack of deposition media for flies which are sexually matured and have copulated. Breeding media ranging from 46 to 55° in 12 hours will permit emergence of adults from puparia, but emergence has never been observed at lower temperatures. Great numbers of pupæ near the surface of the soil receive either enough heat to permit emergence of adults, which usually succumb to cold before depositing or the temperatures are so low that they become inviable. Young larvæ have been kept for more than 67 days without pupating, but only

by occasional additions of small amounts of fresh manure. Larvæ more than one-half normal size have been kept alive for more than 90 days, and still other larvæ of various sizes have been observed to live for 115 days. Adults have been observed to emerge in an empty cage 6 ft. from a manure pile, the pupæ having been produced by migrating larvæ. The greatest larval migration was at least 8 ft. In a naturally accumulated and infested manure pile larvæ and pupæ were overwintered. Adults continued to emerge during mild weather in midwinter as long as manure was added. Emergence stopped when addition of manure ceased, but in spring at least 142 adults emerged."

Transmission of leprosy by the house fly (Musca domestica), E. MARCHOUX (*Ann. Inst. Pasteur, 30 (1916), No. 2, pp. 61–68; abs. in Rev. Appl. Ent., Ser. B, 4 (1916), No. 6, pp. 85, 86*).—The author concludes that the house fly may convey the leprosy bacillus on its recently soiled feet and proboscis, and that the bacillus can live in the digestive tract of this dipteran for at least four days.

Muscoid flies from the southern United States, C. H. T. TOWNSEND (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 4–6, pp. 51–59*).

Some new North American muscoid forms, C. H. T. TOWNSEND (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 7–9, pp. 73–78*).—Six genera are erected and three species described as new, namely, *Ypophæmyia malacosomæ* reared from pupæ of the tent caterpillar at Raleigh, N. C.; *Euzenilliopsis diatrææ* reared from larvæ of the sugar-cane borer in Cuba and from a pupa found in cane at Audubon Park, La.; and *Schizocerophaga leibyi* reared from pupæ of *Schizocerus privatus* at Raleigh, N. C.

On Australian Muscoidea, with description of new forms, C. H. T. TOWNSEND (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 4–6, pp. 44, 45*).

Miscellaneous muscoid notes and descriptions, C. H. T. TOWNSEND (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 10–12, pp. 121–128*).

Notes on the hen flea (Echidnophaga gallinacea), J. F. ILLINGWORTH (*Proc. Hawaii. Ent. Soc., 3 (1916), No. 3, pp. 252–254*).—Substantially noted from another source (E. S. R., 35, p. 58).

Flat-headed borers affecting forest trees in the United States, H. E. BURKE (*U. S. Dept. Agr. Bul. 437 (1917), pp. 8, pls. 9*).—Buprestid larvæ, known as flat-headed borers, are among the most important of the borers infesting forest trees in the United States, some mining the leaves, one burrowing into the cones, a number boring into the inner bark and outer wood of the trunk, branches, and roots, while the majority excavate oval-winding "wormholes" throughout the sound or decaying sapwood and heart wood.

The present paper reports largely upon the distinguishing characters of the larvæ of various species, including illustrations of many and a key to the genera of buprestid larvæ, together with a list of the genera which records their distribution, common habits, and host trees.

The pine bark beetle (Ips pini), W. A. CLEMENS (*New York Cornell Sta. Bul. 383 (1916), pp. 287–298, pls. 2, figs. 4*).—A report of studies of the life history and habits of *I. pini* extending over a period of three years.

The species is common and widely distributed, inhabiting the transitional and Canadian faunal zones ranging from the Pacific to the Atlantic and from about 37 to 55° north latitude. The damage which it causes is usually not of a serious character in itself, though it has been reported to cause the death of certain pines and spruces. In addition to direct injury it may be a source of loss by opening the way for the entrance of fungi and ambrosia beetles.

The winter is usually passed in the bark in the adult stage, migration taking place in the early spring. The eggs hatch in the galleries in five days, at a temperature of 69°, and the young larvæ then bore out into the cambium. The

pupal period lasts about five days. At Ithaca, N. Y., there are at least two generations and under very favorable conditions there may be three.

Its predatory enemies are usually common and its parasites are thought to be numerous. As regards control measures it is pointed out that the removal of the bark will cause the death of all larvæ and pupæ and if it is burned immediately after removal many adults will also be destroyed. Removal and burning of the bark in winter where the adults are known to be in hibernation will do much to lessen attacks in the season following. Where water is available the placing of newly felled logs in it will prevent injury by the beetles.

Mention is made of several common associates.

Biological notes on Ceutorhynchus marginatus, S. W. Frost (*Jour. N. Y. Ent. Soc., 24 (1916), No. 4, pp. 243–253, pls. 3*).—The author has found the larvæ of this weevil to feed on the ovules and seeds of the dandelion at Ithaca, N. Y. The species is common throughout Europe but has been found in this country only in the Northeastern States.

On some weevils attacking orchids, G. C. Champion (*Ent. Mo. Mag., 3. ser., 2 (1916), No. 21, pp. 200–202*).—Under the name *Cholus cattleyæ* the author describes a new weevil which attacks orchids (*Cattleya gigas*) grown in a greenhouse in Bergen County, N. J., and at Milwaukee, Wis., that originated in tropical America. This appears to be the same species as that described by Barber in the paper previously noted (E. S. R., 36, p. 360). A second species described as new to science, *Diorymellus lævimargo*, found attacking orchid roots in a greenhouse at Ithaca, N. Y., and in Bergen County, N. J., feeds on the leaves and flowers of orchids as well and also attacks the flowers of Dendrobium. This weevil also appears to have come from tropical America.

Some unusual orchid insects, H. B. Weiss (*Ent. News, 28 (1917), No. 1, pp. 24–29, pls. 2*).—Among the unusual species which have been found associated with orchids in New Jersey greenhouses are two weevils described by Champion and by Barber as noted above.

A survey of beekeeping in North Carolina, E. G. Carr (*U. S. Dept. Agr. Bul. 489 (1916), pp. 16*).—This is a report of a survey made in 19 counties in North Carolina from October 1 to December 22, 1915. It was made with a view to determining the present conditions, possibilities, and needs of the business of beekeeping, with special reference to the best means of supplying the needs.

The author has found that the State has a large number of bees, pollen and nectar-producing flora in abundance, and the honey when properly produced is of high grade and there is a good market for it. It is thought that extension work in beekeeping should be inaugurated as quickly and carried on as vigorously as circumstances will permit.

The control of ants in dwellings.—A new remedy, A. Gibson (*Canad. Ent., 48 (1916), No. 11, pp. 365, 366*).—The author has found sodium fluorid to control satisfactorily the common carpenter ant (*Camponotus pennsylvanicus*) and the common shed-builder ant (*Cremastogaster lineolata*) in buildings.

Descriptions of various chalcidoid Hymenoptera, with observations, I and II, A. A. Girault (*Ent. News, 27 (1916), Nos. 5, pp. 223–228; 9, pp. 401–405*).—Among the 12 species described as new are *Pseudomphale ancylæ* reared from *Ancylus nubeculana*, Winchester, Va.; *P. steirastomæ* reared from larvæ of *Steirastoma depressum*, Erin, Trinidad; *Holycencyrtus physokermis* reared from *Physokermes picea*, Madison, Wis.; *Xenocrepis mexicana*, parasitic on a scymnid larva which preys upon *Lecanium oleæ* on orange at San Luis, and also from the larva of *Azya orbigera* at Monterey, Mex., in the first paper; and *Coccophagus aleurodici* reared from Aleurodicus on *Theobroma bicolor*, Trinidad;

Neocatolaccus syrphidis, reared from a syrphid pupa, Trinidad, etc., in the second paper.

Nine new species of Hymenoptera, J. C. CRAWFORD (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 7–9, pp. 101–107, fig. 1*).—Among the species here described as new are *Tetrastichus pyrillæ* and *Ooencyrtus pyrillæ*, both reared from eggs of *Pyrilla aberrans*, and from Pusa and Nagpur, India, respectively.

Some new American Hymenoptera, J. C. CRAWFORD (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 10–12, pp. 135–144*).—One genus, seven species, and one variety are here described as new, among which are *Fidiobia rugosifrons* described from eggs in wheat stubble at Montoursville, Pa.; *Microdontomerus fumipennis* reared from *Malacosoma fragilis* at Maxwell, N. Mex.; *Ptinobius texanus* reared from *Otidocephalus carinicollis* at Dallas, Tex., *Trichobaris texana* at Victoria, Tex., and *Aræocerus fasciculatus* at Hallettsville, Tex.; and *Perilampus chrysopæ lævicephalus* reared from *Chrysopa californica* at Sacramento, Cal.

Descriptions of miscellaneous chalcid flies, A. A. GIRAULT (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 10–12, pp. 109–121*).—Twenty new species are here described, of which mention should be made of *Tetrastichus malacosomæ* reared from the eggs of the tent caterpillar and the forest tent caterpillar at Berkeley, Cal., and from the eggs of *Malacosoma fragilis* at Maxwell, N. Mex.; *Eurytoma ctenodactylomyii* and *Neocatolaccus livii*, both reared from the galls of *Ctenodactylomyia watsoni* on sea-grape (*Coccoloba uvifera*) in Porto Rico; *Elasmus mordax* reared from *Lithocolletis guttifinitella* in the District of Columbia; *Pachyneuron mucronatum* reared from an aphid at Guanajuato, Mexico; *Elasmus aspidiscæ* reared from a cocoon of *Aspidisca splendoriferella* on Cratægus in the District of Columbia; and *Isodromus abnormicornis* reared from *Icerya braziliensis* at São Paulo, Brazil.

A remarkable new genus of Encyrtidæ from the West Indies, bearing two ring joints, A. A. GIRAULT (*Jour. N. Y. Ent. Soc., 24 (1916), No. 3, pp. 232, 233*).—The author describes *Ameromyzobia aphelinoides* n. g. and n. sp. from St. Vincent, West Indies.

A new genus of Tetrastichini (chalcidoid Hymenoptera), A. A. GIRAULT (*Ent. News, 27 (1916), No. 8, p. 348*).—The genus Galeopsomyia is erected for *Euderus columbianus*.

The North American species of Dibrachys (in the North American sense—Cœlopisthoidea) with a note on Uriella, A. A. GIRAULT (*Canad. Ent., 48 (1916), No. 12, pp. 408, 409*).

A new species of Lepidopria from North America, C. T. BRUES (*Psyche, 23 (1916), No. 4, pp. 126, 127, fig. 1*).—*Lepidopria aberrans* reared from a tachinid pupa, probably *Cryptomeigenia theutis*, found in an adult June beetle (*Phyllophaga* [*Lachnosterna*] *inversa*) at Hagerstown, Md., is described as new to science.

Notes on the egg parasites of the apple tree tent caterpillar (Malacosoma americanum), L. T. WILLIAMS (*Psyche, 23 (1916), No. 5, pp. 148–153*).—The author presents notes on six species of parasites (*Ablerus clisiocampæ*, *Telenomus clisiocampæ*, *Tetrastichus* spp., *Ooencyrtus clisocampæ*, and *Aphycoideus io*) reared from the eggs of the tent caterpillar, their behavior, and relative abundance.

New chalcid flies from Maryland, A. A. GIRAULT (*Ent. News, 28 (1917), No. 1, pp. 20–23*).—Two genera and six species are described as new to science.

The occurrence of Neoderostenus Girault in North America, A. A. GIRAULT (*Canad. Ent., 48 (1916), No. 12, p. 409*).

A new genus of omphaline eulaphid chalcis flies from Maryland, A. A. Girault (*Canad. Ent., 48 (1916), No. 12, p. 410*).—*Euderomphale fuscipennis* n. g. and n. sp. from a meadow at Glendale, Md., is here described.

Descriptions of and observations on some chalcidoid Hymenoptera, A. A. Girault (*Canad. Ent., 48 (1916), No. 10, pp. 337–344*).—This paper includes descriptions of nine new species representing the genera Eurytoma, Rileya, Asympiesiella, Pleurotropis, Ormyrus, and Habrolepoidea, among which is *A. india* reared from the tar leaf-folder (*Gracillaria soyella*) at Pusa, India; and *H. depressa* reared from the eggs of *Cyllene robiniæ* at Morristown, Ill.

The occurrence of the genus Achrysocharelloidea in North America, A. A. Girault (*Canad. Ent., 48 (1916), No. 10, p. 336*).

The red spider on cotton, E. A McGregor and F. L. McDonough (*U. S. Dept. Agr. Bul. 416 (1917), pp. 72, pls. 8, figs. 21*).—This is a detailed report of studies of *Tetranychus bimaculatus*, its life history and habits, seasonal history, dispersion, insect enemies, and remedial measures, together with descriptions of its several stages. While occurring throughout the United States, it is known as a serious pest in only three regions, namely, in that portion of the cotton belt including North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi, where it is primarily a pest of cotton; in north-central and western Colorado as a pest of fruit trees; and in central California, where the species is a rather serious pest of hop fields (E. S. R., 29, p. 261). It is estimated that during a season of severe red spider occurrence the loss to the cotton planters of the Southeast amounts to approximately $2,000,000. Investigation has shown that it can maintain itself successfully on 183 species of wild and cultivated plants, weeds, vines, bushes, and trees.

"The control of the red spider is possible either by preventive or by repressive measures. Great expenditures of time, labor, and material, however, are necessary when the latter operation is undertaken. . . . Clean culture, or the extermination of weeds and plants which breed the pest, is by far the most vital means of prevention that can be applied in the case of field and truck crops. In cases where cotton is grown within 100 yds. of dooryards containing violets and other ornamental plants a careful watch of these plants should be maintained in order that they may be sprayed or destroyed. By the persistent maintenance of a finely pulverized surface mulch in fields the progress of migrating mites is somewhat retarded and the development of infestation correspondingly discouraged. . . . Trap crops, rotation, favorable planting time, irrigation, etc., are either of only slight or of negative value.

"Dispersion may be prevented by eliminating the plants in a field which harbor the initial infestation. This may be accomplished by pulling the first few plants which show infestation, or, in case the pest has secured a good foothold, the elimination will be accomplished only by means of plowing up all the affected portion of the field. In either case the stalks should be quickly piled and burned with the help of a little straw or light trash.

"Spraying for red spiders is effective if it is done with extreme care. There are a few sprays which will give complete mortality when properly applied, but a second spraying is necessary to kill the individuals that were eggs at the time of the first spraying. A contact insecticide is absolutely necessary, and it is vital that every leaf on an infested plant should be reached by the spray."

A bibliography of four pages is included. A report of studies of this mite in Oregon by Ewing has been previously noted (E. S. R., 32, p. 156).

The sexual evolution of Sarcocystis muris, H. Crawley (*Proc. Acad. Nat. Sci. Phila., 68 (1916), pt. 1, pp. 2–43, pls. 5*).

FOODS—HUMAN NUTRITION.

Studies of the values of different grades of milk in infant feeding, R. M. Washburn and C. H. Jones (*Vermont Sta. Bul. 195 (1916), pp. 144, pls. 9, figs. 10*).—The experiments reported in this bulletin were carried out with baby pigs, with the view of adapting the findings to infant feeding.

Studies of the effect of feeding skim, medium, and rich milks showed that "the character of the tissue produced is determined by and closely parallels the chemical composition of the food consumed. A ration supplying a large amount of protein in proportion to the total energy available (e. g., skim milk) produced sturdy, agile, but rough and undersized pigs. Milk carrying a medium fat content (2.5 per cent) and, hence, less protein in proportion to the total units of energy available than does skim milk, produced healthy, 'growthy,' active, yet smooth and fair-sized pigs. Milk containing a large quantity of fat (5 per cent) in proportion to protein, produced a rapid increase in weight and physiologically economical gains; but the pigs were in a dangerously overfat condition and betrayed peevishness and low vitality. The body of the young pig and, if the results of these trials are applicable to human infant feeding, that of the human young, should not contain much more than approximately 1.6 parts of fat for every one part of protein. If a ration carrying a nutritive ratio of about 1:3 is used, a 1:1.6 result, or an approximation to such a result may be expected."

From their study of the relative values of Holstein and Jersey milks, the authors are of the opinion that the size of the fat globules has no practical bearing on the relative values of milks in infant feeding, and that any superiority for infant feeding attributed to Holstein milk is more likely to lie in its relatively low fat content than in the relatively small size of the fat globules.

The evidence obtained in experiments with homogenized milk indicated that homogenization of the fat does not seem to be helpful in feeding the young. "The pigs fed the milks thus treated ate their food less greedily and, whenever the fat content of their ration was increased, went 'off feed' more quickly than did those receiving milk containing normal fat. However, the curds formed from milk the casein of which had been homogenized were made so much more flocculent and friable as a result of this process that [it appears] that perhaps benefit may be expected from such treatment. The quantity of fat fed is of much more importance in the constitution of the body tissue than is the size of the fat globules." When medium amounts of fat (2 to 3 per cent) were fed there appeared to be a slightly increased fat utilization favoring homogenization.

Tests of evaporated (unsweetened) and condensed (sweetened) milks showed that both were readily digested and assimilated and their nutrients appropriated for tissue growth. "Evaporated milk compared very favorably indeed with normal milk, standardized to a medium fat percentage, in nutriment and in tissue production." While sweetened condensed milk showed an abundant energy value it proved an undesirable food for the young, since its nutrients were so proportioned as to produce a weak and dangerously fat body.

The question of the effect of food upon the structure of the bones was studied, particularly on account of its relation to rickets and other forms of malnutrition. From these tests the following conclusions were drawn: "The femur of the average pig fed sweetened condensed milk was but two-thirds as strong as that formed when normal milk was fed. Only a slight difference appeared between the normal and the evaporated milk groups in regard to the breaking strength of their femurs, but this difference favored the normal

product. In spite of the high ash percentage utilization by the pigs fed sweetened condensed milk, their body gain contained less ash than did the gains of either the normal or the evaporated-milk-fed-animals. Tricalcic phosphate does not seem to be a particularly available form in which to furnish lime and phosphoric acid."

Although the authors state that definite conclusions can not be drawn on this point, somewhat limited trials indicated that overdilution of the milk rations tended to lessen their food value.

In conclusion the authors discuss at length the principles of infant feeding in light of these experiments and clinical evidence. Special attention is given to the American, or percentage system, and the German, or calorific system, of infant feeding and to suggestions for a combination of these two methods. The compositions of human, cows', and sows' milks are compared. There is also an extended discussion of the digestion of milk which touches mainly on the following points: Casein digestion, the effect of colloids and cereals on curd structure, the rate of coagulation in the stomach, digestion of milk serum, and fat digestion.

A bibliography of cited literature is included, together with an appendix, which contains the clinical records of the animals used as subjects of the experiments.

Value of different grades of milk in infant feeding, R. M. WASHBURN and C. H. JONES (*Vermont Sta. Bul. 201 (1916), pp. 32, pls. 4, figs. 6*).—This is a popular edition of Bulletin 195, noted above.

Studies of infant feeding.—The chemical changes produced by the addition of limewater to milk, A. W. BOSWORTH and H. I. BOWDITCH (*Jour. Biol. Chem., 28 (1917), No. 2, pp. 431–435*).—The results of this investigation showed that although the addition of limewater to milk increases the total amount of CaO, it results in a marked change in the arrangement of the salts, bringing about the precipitation of calcium, phosphorus, and citric acid, a mixture of dicalcium ($CaHPO_4$) and tricalcium ($Ca_3P_2O_8$) phosphates being the insoluble phosphates formed. By the addition of limewater the reaction of the serum of milk is brought toward the neutral point, the soluble alkalinity of the limewater being used up in the precipitation of the insoluble calcium phosphates.

"When milk to be used for infant feeding is treated with limewater and finally diluted to such an extent that it has twice the volume of the original milk, or more, the soluble calcium and phosphorus may be reduced to amounts less than those which are present in human milk."

The influence of the coagulation by rennin upon the gastric digestion of milk protein, J. T. LEARY and S. H. SHEIB (*Jour. Biol. Chem., 28 (1917), No. 2, pp. 393–398*).—The object of this investigation was to throw some light upon the differences in results obtained by other workers regarding the influence of the coagulation by rennin upon the subsequent gastric digestion of milk protein.

The data obtained confirmed the results of Abderhalden and Kramm,[1] who found that clotted milk was more easily digested than milk in which coagulation had been prevented by the use of an oxalate, but in the latter case peptic digestion was believed to be inhibited by the presence of the oxalate solution. The internal digestion of the paracasein curd by adsorbed pepsin is deemed of rather minor importance. Through a slightly different method from that employed by Hawk (E. S. R., 15, p. 494), his conclusions were verified that pepsin acts much more readily upon the protein constituents of milk where no thick, elastic curd of paracasein is formed. The formation of the curd of paracasein was found to depend upon the strength of the hydrochloric acid

[1] Ztschr. Physiol. Chem., 77 (1912), No. 6, pp. 462–470.

in the juice and the quantity of rennin present. The peptic digestion of boiled milk was slightly more rapid than that of raw milk.

Cereal foods in the course of history, A. MAURIZIO (*Die Getreide-Nahrung im Wandel der Zeiten. Zurich: Orell Füssli, 1916, pp. V+237, figs. 53*).—This book summarizes information regarding the production, preparation, and use of cereals in various parts of the world from prehistoric times to the present day, among the people of all grades of civilization, including primitive races. Notes are also given on the use of some food plants other than cereals and on many types of so-called famine and war breads. Many types of cereal foods found in the Balkan and Scandinavian peninsulas are described. The publication contains many illustrations of grinding and milling devices, ovens, cooking utensils, etc.

Milling and baking tests of Victorian wheat, P. R. SCOTT and F. G. B. WINSLOW (*Jour. Dept. Agr. Victoria, 14 (1916), No. 11, pp. 641–652, figs. 2*).—The results are reported of tests made of several samples of wheat grown during the season 1915–16 at the different experimental farms, continuing previous work (E. S. R., 33, p. 659).

Is lysin the limiting amino acid in the proteins of wheat, maize, or oats? E. C. MCCULLOM, N. SIMMONDS, and W. PITZ (*Jour. Biol. Chem., 28 (1917), No. 2, pp. 483–499, pl. 1, figs. 12*).—The experiments here reported showed the following results:

Zein does not supplement the protein in the wheat or maize kernel so as to improve the rate of growth of young laboratory animals (rats). Zein does, however, supplement the protein of the oat kernel in an efficient manner, although it lacks tryptophan and lysin, and is one of the poorest proteins in cystin. In the protein of the oat kernel, therefore, these amino acids are eliminated as being possibly the essential protein cleavage products present in minimal amount, and determining the plane of intake essential for growth.

"Gelatin chemically supplements the protein mixture of both the wheat kernel and oat kernel, respectively. Since gelatin contains no tyrosin or tryptophan, and but a trace of cystin, but contains 6 per cent of lysin, it is evident that neither tyrosin, tryptophan, nor cystin is the limiting amino acid in these grains. It tends to support the view, but does not prove, that lysin is the amino acid whose addition alone to the wheat protein mixture raises the biological value of the latter."

The addition of wheat gluten to the wheat or maize kernel proteins supplements them so as to improve growth. The proteins of the wheat gluten, as a mixture, are probably qualitatively adequate as regards all of the indispensable amino acids, although this point is not definitely established.

The authors state that the combinations of wheat gluten with wheat-kernel proteins or maize-kernel proteins led to growth probably because of a higher intake of protein rather than a supplementary relationship between the proteins from the two sources in the sense of one making up for the amino-acid deficiencies of the other. The results of feeding maize proteins with wheat gluten are of particular interest, however, because of their pronounced effect in promoting growth despite the relatively low lysin content of both the wheat and maize proteins.

"Gelatin with its high lysin content does not improve the proteins of the maize kernel."

Homemade bread substitutes for diabetic patients, R. T. WILLIAMSON (*Brit. Med. Jour., No. 2921 (1916), pp. 870, 871*).—Recipes are given.

Potatoes, sweet potatoes, and other starchy roots as food, C. F. LANGWORTHY (*U. S. Dept. Agr. Bul. 468 (1917), pp. 29, figs. 7*).—This bulletin summarizes general and experimental data regarding the composition, nutritive value, and

cookery of the potato, sweet potato, Jerusalem artichoke, and some tropical starch-bearing roots—the cassava, yam, dasheen, yautia, and taro. There is also a discussion of some potato products (starch and dried and canned potatoes), the selection of potatoes for the table, and the effect of storage on quality. The bulletin is a revision in part of Farmers' Bulletin 295 (E. S. R., 19, p. 164).

Canned tomatoes, A. McGill (*Lab. Inland Rev. Dept. Canada Bul. 357 (1916), pp. 31*).—This bulletin reports the results of the inspection of 232 samples of canned tomatoes purchased in various parts of the Dominion of Canada.

Determinations of preservatives in caviar, Köpke (*Arb. K. Gsndhtsamt., 50 (1915), No. 1, pp. 31–37*).—Data are given regarding the composition of different samples of commercial caviar and the amounts of preservatives found, together with some discussion of the methods used.

The nutritive value of wood, G. Haberlandt (*Sitzber. K. Preuss. Akad. Wiss., 1915, XIV, pp. 243–257*).—The starch, fat, and protein content of different kinds of wood, different sections of the same kind, and its seasonal variations are discussed.

Original measurements of the proportion of starch-holding tissues of typical trees are reported, from which the author concludes that such tissues make up from $\frac{1}{8}$ to more than $\frac{1}{4}$ of the total volume of the wood. The reserve stores of starch and fat within the wood are considered highest in autumn and winter. The literature relating to the ultilization of wood as food for man and domestic animals is reviewed and the conclusion drawn that the finely-ground substance of the growing wood from certain trees could be combined with flour in bread making, providing some method of treating the cellulose could be found which should make the nutrients it surrounds accessible to the digestive juices.

The iodin content of food materials, R. M. Bohn (*Jour. Biol. Chem., 28 (1917), No. 2, pp. 375–381*).—The author reports results of determinations of iodin made upon a variety of foods and feeding stuffs, two natural waters, and several rock salts. Three methods for the determination of iodin in organic matter were compared, the one proposed by Kendall[1] being regarded by the author as the most accurate.

The majority of samples contained no iodin, although some showed the presence of a trace. The author concludes that the presence of iodin in feeding materials of vegetable origin "is accidental and serves no necessary nutritive function in the plant. Further, the iodin requirements of animals must of necessity be met by the traces that occur in plant materials, waters, etc."

The results obtained are in agreement with those of Forbes, Beegle, et al. (E. S. R., 35, p. 761).

[Eighteenth and nineteenth annual conventions of the Association of American Dairy, Food, and Drug Officials] (*Proc. Assoc. Amer. Dairy, Food, and Drug Officials, 18 (1914), pp. 472, figs. 16; 19 (1915), pp. 228*).—These publications report, respectively, the proceedings of the meetings at Portland, Me., July 13–18, 1914, and Berkeley, Cal., August 2–5, 1915.

Among the papers read at the 1914 meeting were the following: Regulation of Food Supplied Hotels, with Particular Reference to Sanitary Conditions Involved in Its Preparation, by G. G. Frary; When Is an Orange Mature and Wholesome, by R. E. Rose; Egg Albumin in Baking Powders, by E. F. Ladd; Cause of Variation in Weight or Measure of Food Products, by L. M. Tolman and W. E. Hillyer; Ice Cream Standards—Necessity for Standards, by W. B. Barney; Ice Cream Standards, by J. G. Winkjer; and State Drug Inspection, by A. R. Todd.

[1] Jour. Biol. Chem., 19 (1914), No. 2, pp. 251–256, fig. 1.

Those presented in 1915 included the following: Exclusion from Official Establishments of Employees Affected with Communicable Disease, by H. H. Hicks; Effect of Storage on Coffee, by R. E. Doolittle and B. B. Wright; Effect of Storage on Moisture Content of Cloves, by A. W. Ogden; Physical Examination of Employees Handling Food Products—Necessity, Progress Made, Outlook, by H. E. Barnard; and Sanitary Problems of the Soft Drink Establishment, by G. B. Taylor.

The reports of the various committees are given for each year.

The sanitation of public markets, D. B. Armstrong (*Jour. Amer. Med. Assoc., 68 (1917), No. 2, pp. 103–106*).—In this paper the major points discussed are the control of the quality of the products by laboratory examination, which includes chemical, bacteriological, and calorific analyses; the condition of the market building; sanitary aspects of the market equipment and the methods of handling food; and administrative control. Special emphasis is laid upon the importance of the health and cleanliness of the employees, as essentials to which are given a living wage, the selection of healthy persons as employees, periodic medical examinations, and the provision of adequate sanitary toilet and hand-washing facilities.

Three delicious meals every day for the farmer, G. W. Carver (*Alabama Tuskegee Sta. Bul. 32 (1916), pp. 13*).—This bulletin suggests an increase in the amount and kind of foods raised on the farm, and includes menus for one week, together with some recipes. It is intended especially for the use of negro farmers in the South.

The rural school lunch, Nellie W. Farnsworth (*St. Paul, Minn: Webb Publishing Co., 1916, pp. 42, figs. 12*).—Information is given regarding equipment and service. Recipes are included.

Typical electric range designs, E. A. Wilcox (*Jour. Electricity, 38 (1917), No. 1, pp. 13, 14, figs. 4*).—Descriptions are given of different types of electric heating units and ranges.

The effects on higher animals of the sterilization of the inhabited medium, the air, and the food, I. Kianizin (*Jour. Physiol, 50 (1916), No. 7, pp. 391–396*).—This is a summary and digest of experiments by the author, as well as of those of other investigators, along this line.

It is stated that in the author's experiments higher animals soon died when the micro-organisms were absent from the air and food, the length of life varying in different animals. The experiments of numerous other investigators showed that the absence or partial absence of micro-organisms has a deleterious effect on nutrition. The author states that the micro-organisms of air are essential to life, and that in the absence of micro-organisms an imperfect assimilation of nitrogen compounds occurs.

Studies of the gastric residuum.—I, A study of 80 samples of gastric residuums obtained from apparently normal women, C. C. Fowler and Zelma Zentmire (*Jour. Amer. Med. Assoc., 68 (1917), No. 3, pp. 167–170, figs. 4*).—The observations here reported did not give evidence of any striking differences between the gastric residuums of normal women and normal men. The average volume found was approximately 49 cc.

Pancreatic diabetes in the dog.—IV, The influence of pylorus exclusion and of gastrectomy upon the effects of pancreatectomy, J. R. Murlin and J. E. Sweet (*Jour. Biol. Chem., 28 (1916), No. 1, pp. 261–288*).—The results of these experiments with laboratory animals (dogs), taken in conjunction with the results of the work of another investigator, which shows the extreme sensitiveness of the mechanism for the oxidation of glucose to the concentration of hydrogen ions, and earlier work by the senior author, which demonstrates the beneficial effect on the oxidation of glucose of administered alkali to totally

and partially depancreatized dogs suggest that "the internal function of the pancreas may be closely akin to its external function in that, on the one hand (external), it provides for the complete neutralization of the acid contents of the stomach, thereby protecting the liver in its glycogenic function, and on the other (internal), it somehow preserves the proper concentration of hydrogen ions in the tissues for combustion of glucose."

Scurvy in Zhob, Baluchistan, A. L. SHEPPARD (*Indian Jour. Med. Research, 4 (1916), No. 2, pp. 340–358*).—In the light of his experience as medical officer, the author discusses the occurrence of scurvy in this region, together with the etiology of the disease, its symptoms, etc.

ANIMAL PRODUCTION.

Digestibility of the cell wall of wood, G. HABERLANDT and N. ZUNTZ (*Sitzber. K. Preuss. Akad. Wiss., 1915, XLI, pp. 686–708, fig. 1*).—This reports the results of an anatomical and microscopical study of birch wood, the preparation and microscopical nature of birch-wood dust (ground wood), the chemical constitution of birch wood and dust, a metabolism experiment with a sheep to determine the digestibility and evaluation of birch-wood dust as a feeding stuff, and a microscopical examination of the excrement of the experimental animal. The wood examined was found to have the following percentage composition: Water 4.56; nitrogen, 0.108 (protein, 0.675); either extract, 0.45; nitrogen-free extract, 61.56; crude fiber, 32.3; and ash, 0.46.

The experimental animal received a daily ration consisting of 450 gm. of wood dust, 30 gm. of wheat gluten, 100 gm. of molasses, and 75 gm. of starch, together with 5 gm. calcium carbonate and 100 cc. of salt solution containing 5 gm. sodium acid phosphate, 1 gm. magnesium sulphate, and 3 gm. sodium chlorid. From the results obtained it is concluded in general that partially or completely wooded cell walls such as occur in birch wood are to a very large extent digestible by ruminants. The complete comminution of the wood, which was principally to liberate the cell contents, also destroys the cell walls, thus making them more digestible.

The question as to the value of this material for other ruminants is noted and a further study to determine the practical value of its feeding is indicated.

Commercial feeding stuffs, 1915–16, C. D. WOODS (*Maine Sta. Off. Insp., 79 (1916), pp. 53–136*).—Tabulated data are given showing registrations of feeding stuffs and notes on the results of the examination of 675 samples. A brief statement is presented by A. M. G. Soule upon the results of feeding-stuffs inspection in the State in 1915–16.

Commercial feeding stuffs, J. L. HILLS, C. H. JONES, and G. F. ANDERSON (*Vermont Sta. Bul. 197 (1916), pp. 45*).—These pages contain notes on the results of the 1916 inspection. The large percentage of samples deficient in the claims of the guaranty is noted.

Cottonseed meal compared with velvet beans for fattening steers, G. S. TEMPLETON and E. GIBBENS (*Alabama Col. Sta. Bul. 192 (1916), pp. 135–141, pls. 2*).—A comparison was made of the relative feeding value of cotton-seed meal and velvet beans in pods as supplements for corn silage for fattening steers. Forty native 1 to 2 year old grade Hereford, Shorthorn, and Angus steers averaging about 584 lbs. were used in the test. The experiment, which began December 18, 1915, and lasted 97 days, was conducted under average farm conditions at Allenville, the steers being fed in the open. Twenty of the steers were fed cottonseed meal at the rate of from 2.76 lbs. per steer daily at the beginning to 6.46 lbs. at the end of the experiment, and the other 20 steers velvet beans at the rate of from 5.7 lbs. at the beginning to 12 lbs. when on

full feed. The velvet beans and pods were ground coarse for two weeks but after this they were fed unground, both the unground and ground velvet beans being mixed with the silage.

The steers on cottonseed meal consumed 2.58 lbs. of meal and 24.09 lbs. of silage per pound of gain and gained 1.6 lbs per head daily at a cost of 7.52 cts. per pound of gain. Those on velvet beans consumed 6.36 lbs. of beans and 16.55 lbs. of silage per pound of gain and gained 1.5 lbs. per head daily, the cost per pound of gain being 7.77 cts. In this test cottonseed meal was valued at $35, velvet beans $18, and corn silage $2.50 per ton. It is estimated that 1 lb. of cotton-seed meal was equal to 2.5 lbs. velvet beans in pods for these steers.

Cattle feeding.—XII, Winter steer feeding, 1915–16, J. H. SKINNER and F. G. KING (*Indiana Sta. Bul. 191 (1916), pp. 35; pop. ed., pp. 8*).—In the experiments reported in this bulletin, which are in continuation of those already noted (E. S. R., 35, p. 475), the cattle and the feed were both of poor quality, and as a result the gains were below normal.

Seven lots of 10 steers each were fed for 150 days, all the lots receiving shelled corn, and all except lot 6, 2.5 lbs. of cottonseed meal per 1.000 lbs. live weight in addition to the supplements given in the table below. Each lot of cattle contained 10 hogs. All of the hogs received corn in addition to droppings from the cattle, and 5 hogs in each of lots 2, 3, and 4 received a small quantity of shorts and tankage.

In a comparison of corn silage and leguminous hay *v.* leguminous hay for fattening steers, involving lots 2, 3, 4, and 7, it was found that corn silage in the ration reduced the amount of corn required and practically replaced the hay. Only about 2.5 lbs. of hay per head daily was consumed by the lots on silage. With clover hay as roughage replaced by 14.2 lbs. of corn silage there was a saving of 1.5 lbs. of corn and 5.6 lbs. of hay on every pound of gain. With alfalfa hay as roughage there was a saving of 1.91 lbs. of corn and 4.97 lbs. of hay by the use of 13.11 lbs. of silage.

In a comparison of clover hay *v.* alfalfa hay as roughage for fattening steers, involving lots 2, 3, 4, and 7, the results indicate that for all practical purposes these two hays are of equal worth when furnishing the only roughage. However, when both hay and silage were fed, the steers receiving alfalfa hay excelled those receiving clover hay in every factor except in pork production.

A limited feed of corn was compared with a full feed of corn for fattening cattle, involving lots 1 and 4. Lot 1 received the following amounts of shelled corn per steer daily: First month none, second month 5 lbs., third month 7 lbs., fourth month 8 lbs., and fifth month 9 lbs. Lot 4 received all the shelled corn they would eat. The average difference in corn consumption for the two lots during the entire period was 4.01 lbs. per steer daily. Lot 1 consumed 3.09 lbs. of clover hay and 33.01 lbs of silage, as compared with 2.04 lbs. of clover hay and 28.64 lbs. of silage for lot 4. Limiting the amount of corn saved 1.84 lbs. of corn on each pound of gain made by the cattle, this being replaced by 0.06 lb. of cottonseed meal, 0.6 lb. of clover hay, and 2.96 lbs. of silage.

In a comparison of cane feeding molasses *v.* proprietary molasses feed as supplements to rations for fattening cattle, involving lots 4, 5, and 6, it was found that the substitution of a small quantity of molasses for an equal quantity of corn increased the appetites of the steers, especially during the latter part of the feeding period. The increase of feed consumption was mostly of corn silage, the average amount of silage eaten per steer daily being 4 lbs. more when molasses was used. The substitution of proprietary molasses feed for cottonseed meal caused only a slightly larger feed consumption on the part of the cattle.

Other data in reference to these comparisons and upon the experiments in general are given in the following table:

Steer-feeding trials.

Lot.	Variable portion of ration.	Average daily gain per head.	Cost per pound of gain.	Selling price per pound.	Profit per steer, not including pork.	Pork produced per lot.	Profit per steer, including pork.[1]
		Lbs.	*Cts.*	*Cts.*		*Lbs.*	
1	Clover hay and corn silage	1.92	10.55	8.60	$9.26	1,143	$14.63
2	Clover hay	2.09	12.33	8.65	3.97	1,107	9.55
3	Alfalfa hay	2.06	12.23	8.65	4.09	1,203	10.59
4	Clover hay and corn silage	2.02	11.39	8.70	7.60	1,156	13.61
5	Cane molasses, clover hay, and corn silage	2.25	11.35	8.75	7.48	855	11.52
6	Molasses feed, clover hay, and corn silage	1.90	12.73	8.60	3.16	1,125	9.24
7	Alfalfa hay and corn silage	2.35	9.93	8.75	12.10	1,075	17.61

[1] Cost of additional feed consumed by hogs deducted.

Feed costs and profits in these experiments were based upon the following figures: Initial value of steers 6.9 cts. per pound; pork 9.75 cts. per pound; corn 55.9, 62.5, 62.4, 58.2, and 63.7 cts. per bushel from the first to the fifth months, respectively; and cottonseed meal $38, molasses feed $31, cane molasses $30, clover hay and alfalfa hay $12, and corn silage $4.50 per ton.

Skim milk and milk substitutes for calf feeding, O. F. Hunziker and R. E. Caldwell (*Indiana Sta. Bul. 193* (*1916*), *pp. 3–104*, *figs. 31*).—In these experiments three lots of 10 calves each, for the most part pure-bred Jerseys, Holsteins, and Ayrshires, were fed for 182 days. Individual photographs taken under standard conditions to show the physical condition and variations in size, representing six 30-day periods in the first six months in each calf's life, are reproduced together with a tabulated average daily summary of the feeds consumed, composition and cost of ration, and variations in live weight for each of the 26 weeks of the experiment.

All the calves remained with their dams until four or five days of age, at which time they were placed on bucket feeding. The calves in lot 1 were fed whole milk until they were three weeks old, the whole milk being gradually replaced by skim milk during the second and third weeks after which a full ration of skim milk was fed in most instances until six months old. In addition to skim milk they had a dry mash of ground corn and oats, equal parts by weight, choice alfalfa hay, and a small amount of corn silage, the grain, hay, and silage being placed before them at ten days of age.

The calves in lot 2 were fed whole milk until five weeks of age, this being gradually replaced (beginning at seven days of age) by a home-mixed calf meal (containing hominy feed, linseed meal, red dog flour, and dried blood, equal parts by weight) mixed with water in the proportion of 1:7. Whole milk was fed to the calves that developed digestive disturbances or were otherwise off feed until the eleventh week. By the time the regular feeding of whole milk was discontinued the calves were getting from 18 to 20 oz. of the mixed meal per head daily, which amount was increased to 24 oz. by the time they were six months old. Otherwise this lot had the same feeds as lot 1.

Lot 3 received whole milk regularly until five weeks of age, this being gradually replaced by a proprietary calf meal beginning during the second week, the calf meal being gradually increased and mixed with water in accordance with directions of the manufacturers until they were receiving a full ration of 17 oz. per head daily at five weeks. This amount was increased to 22 oz.

at six months. Whole milk was fed frequently throughout the test when the calves were off feed. Otherwise this lot had the same feeds as lots 1 and 2.

Water and salt were before the calves at all times and particular care was used to insure a uniform temperature of the milk and milk substitute rations. Analyses are given of all the feeds used in the experiments.

The following table gives some of the results obtained:

Calf feeding trials.

Lot.	Birth weight.	Final weight.	Daily gain per calf.			Cost per pound of gain.	Total cost.	Average daily rations.				Nutritive ratio.
			Maximum.	Minimum.	Average.			Dry matter.	Crude protein.	Carbohydrates.	Fat.	
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Cts.*		*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
1	61.7	282.8	1.49	0.89	1.21	5.7	$12.63	4.46	0.930	3.14	0.106	1:3.6
2	69.6	244.1	1.39	.63	.95	7.4	12.93	4.15	.930	2.84	.165	1:3.4
3	68.2	200.2	.95	.45	.73	13.1	17.44	3.45	.687	2.37	.189	1:4.0

Cost data in these experiments are based upon the following prices: Whole milk $1.50 and skim milk 25 cts. per 100 lbs.; corn 60 cts. and oats 40 cts. per bushel; and alfalfa hay $15, silage $4, home-mixed calf meal $40, and proprietary calf meal $70 per ton.

The calves in lot 1 maintained a thrifty condition throughout the test, although considerable trouble was experienced by short attacks of indigestion or scours. The percentage cost of each feed for this lot was whole milk 15.5, skim milk 39.9, dry mash 16.38, alfalfa hay 27.07, and corn silage 1.15.

The calves in lot 2 did not present a thrifty appearance during the first part of the test. Indigestion caused a great deal of trouble, but this was usually checked by the substitution of whole milk for a part of the milk substitute. The calves' appetites were good after the eighth week. The percentage cost of this lot was whole milk 24.82, home-mixed calf meal 37.71, dry mash 13.76, alfalfa hay 23.04, and corn silage 0.67.

The calves in lot 3 were not very thrifty during the first part of the experiment, indigestion being the chief trouble in the majority of cases. This was usually remedied by the substitution of whole milk for a part of the proprietary calf meal. In two instances calves failed to recover from attacks of indigestion and lack of proper nutrition, one dying at the age of 40 days and the other at the age of 45 days. With one exception the remaining calves of this lot presented a thrifty condition at the end of the test. The percentage cost of each feed for this lot was whole milk 38.53, proprietary calf meal 39.16, dry mash 9.23, alfalfa hay 12.61, and corn silage 0.47.

Detailed consideration is presented of the variation in weight of calves, cost and amount of rations consumed, food nutrients received, and growth of the calves in each lot, together with a summary of the comparative efficiency of the various rations used in the experiments.

It is concluded that the use of skim milk for young calves, where it is available in large quantities, should be encouraged unless its market value is over 30 cts. per 100 lbs. Where the chief product sold from farms is whole milk "the use of a home-mixed calf meal is advisable, although the calf so produced will not be as well developed at 6 months of age as if fed milk during its early growing period.

"The prices charged by concerns manufacturing calf meals are usually very much above the actual cost of producing them, chiefly on account of advertising

cost, transportation charges, and dealers' profits. All things being equal so far as the efficiency of the ration is concerned, the use of a ready-prepared calf meal is largely prohibitive on account of the high retail prices of such feeds. . . .

"In order for a ration to be considered an unqualified success for dairy calves, it should produce at least 1 lb. of gain per day as an average for the first six months of the life of the calf. An average daily gain of 1.5 lbs. is not uncommon, although slightly above that which the average dairyman may expect.

"The amount of grain mixture and dry roughage consumed by dairy calves is a splendid index to their thriftiness. . . . The amount of food nutrients required per day by growing calves is approximately 0.33 lb. of protein, 1 lb. of carbohydrates, and 0.05 lb. of fat. The above figures are based upon the total amount rather than the amount of digestible nutrients consumed.

"The rate of growth in height of dairy calves is rather uniform during the first six months of their lives. The average monthly growth for an average sized calf should be from 1.5 to 2 in., although certain individuals may much exceed these figures. As dairy calves advance in age their relation between height and weight gradually changes. A calf at 30 days of age should weigh approximately 3 lbs. for each inch in height. This figure gradually increases until, at six months of age, the average calf should weigh approximately 6.5 lbs. for each inch in height."

The efficiency of certain milk substitutes in calf feeding, R. H. Carr, G. Spitzer, R. E. Caldwell, and O. H. Anderson (*Jour. Biol. Chem., 28 (1917), No. 2, pp. 501–509, figs. 6*).—Experiments conducted at the Indiana Experiment Station are reported, the objects of which were to determine to what extent a calf meal made up of both animal and vegetable feeding materials, rich in protein, could take the place of skim milk, and whether the proteins from wholly vegetable sources are capable of producing growth and development of the calf to the same extent as the proteins from animal sources.

Fresh separator skim milk was fed at 98° F. The calf meals were mixed with water (1:12 by weight) and fed at the rate of 4 oz. of dry meal at first to 12 oz. on full feed, the mash being fed at a temperature of 98°. The calves had a dry mash of equal parts of ground corn and oats, and alfalfa hay. A sample was taken from each meal at the time of mixing for chemical estimation of the nitrogen content, and from this the amount of nitrogen consumed daily was calculated. The meals used were mixed as follows: Vegetable meal—linseed meal, soy bean meal, cotton-seed meal, and wheat middlings (equal parts by weight); home-mixed meal—hominy feed, linseed meal, flour, and dried blood (equal parts by weight); vegetable-dried-blood meal—soy bean meal, linseed meal, cotton-seed meal, wheat middlings, and dried blood (equal parts by weight); and home-mixed casein meal—hominy feed, linseed meal, flour, and casein (9:9:9:8 by weight). Old-process linseed meal was used in these mixtures.

The feeding experiment in which 4 calves were used was divided into three periods of 29, 25, and 18 days each. The rations were changed for each period of the test, skim milk being fed for one period to each calf and one of the mixed meals to 2 calves for one period, so that each calf received skim milk and two of the mixed meals in the course of the experiment. Of the nitrogen consumed in the different rations the following percentages were retained: Skim milk 40.7, home mixed meal 32, home mixed casein meal 30, vegetable meal 27.3, and vegetable-dried-blood meal 22.6. The gains in grams of body weight per gram of nitrogen consumed for the different rations were skim milk 34.41, home mixed

casein meal ration 32.74, vegetable-dried-blood meal ration 26.85, home mixed meal ration 26.17, and vegetable meal ration 26.14. The nitrogen intake was rather constant per kilogram of body weight, the maximum difference being 12 per cent. It appeared that when the nitrogen in the ration was the most suitable for growth the nitrogen excreted was about equally divided between the feces and the urine.

Sheep feeding.—VI, Fattening western lambs, 1915–16, J. H. Skinner and F. G. King (*Indiana Sta. Bul. 192 (1916), pp. 20; pop. ed., pp. 7*).—In these experiments, which are in continuation of those already noted (E. S. R., 35, p. 476), nine lots of 25 lambs each were fed for 100 days, eight of the lots being fed in open sheds and one lot in the barn. The lambs were choice improved Mexicans of excellent quality. The rations fed, in addition to shelled corn, and some of the results obtained are given in the following table:

Lamb feeding trials.

Lot.	Ration, in addition to shelled corn.	Feed consumed per pound of gain.			Average daily gain per head.	Cost per pound of gain.	Final value of lamb per pound.	Profit per lamb.
		Grain.	Dry roughage.	Silage.				
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Cts.*	*Cts.*	
1	Cottonseed meal and corn silage	5.48	0.58	10.77	0.175	8.86	10.05	$0.80
2	Cottonseed meal, molasses, clover, and corn silage	3.99	4.64	4.35	.256	8.49	10.40	1.29
3	Clover hay	4.19	7.57	....	.24	8.81	10.20	1.02
4	Alfalfa hay	3.87	6.55	....	.26	7.87	10.75	1.74
5	Cottonseed meal, corn silage, and oat straw	5.78	3.63	7.37	.172	9.11	9.65	.46
6	Corn silage and clover hay	4.07	4.74	4.52	.247	8.00	10.30	1.31
7	Cottonseed meal, corn silage, and clover hay	4.00	4.65	4.45	.252	8.26	10.90	1.74
8	Ground soy beans, corn silage, and clover hay	4.14	4.78	4.61	.243	8.52	10.65	1.45
9	Corn silage and clover hay fed in barn	4.22	4.91	4.57	.239	8.27	10.30	1.22
	Average	4.33	4.86	4.18	.232	8.42	10.37	1.23

In a comparison of corn silage *v.* corn silage and clover hay for fattening lambs, involving lots 3 and 6, it was found that the addition of silage to a ration of shelled corn and clover hay had no effect on the grain consumption, but that 112 lbs. of silage replaced 65 pounds of clover hay in roughage consumption. Comparing corn silage alone *v.* corn silage and dry roughage, involving lots 1, 5, and 7, it was found that with the elimination of dry roughage from the ration there was a decrease in grain consumption and an increase in silage consumption. When oat straw was fed in connection with silage more corn was required to produce a pound of gain than when either silage alone or silage and clover hay were fed.

In a comparison of clover hay and alfalfa hay, involving lots 3 and 4, the hay consumption was higher when clover was fed, and the finish on the lambs better when alfalfa was fed. In this test the clover hay was slightly moldy and the alfalfa hay of excellent quality. The addition of cottonseed meal at the rate of 3 lbs. per day for 25 lambs to a ration of shelled corn, clover hay, and corn silage, involving lots 6 and 7, had no effect on the daily feed consumption, but apparently gave a much better finish to the lambs. In substituting a small quantity of cane molasses for an equal quantity of corn in a ration of shelled corn, cottonseed meal, clover hay, and silage, involving lots 2 and 7, no marked effects on the appetites or finish of the lambs were noted.

Ground soy beans and cottonseed meal were compared as supplements, involving lots 7 and 8. The appetites of both lots were equally good, but the results slightly favored cottonseed meal. In a comparison of open shed *v.* barn as shelter for fattening lambs, involving lots 6 and 9, no difference was found in grain or hay consumption of the two lots. Silage consumption was slightly greater in the open shed, this being due to the fact that these lambs learned to relish silage sooner than those in the barn.

Other data in reference to comparisons of feeds and shelter are given in the above table.

The cost of gains and profits were based on the following figures: Initial value of lambs 8.85 cts. per pound; corn, first month 47.2, second month 54.8, third month 61.7, and last 10 days 64 cts. per bushel; oats (a small quantity of which was used in accustoming lambs to rations) 32 cts. per bushel; and cottonseed meal and ground soy beans $38, molasses $30, clover and alfalfa hay $12, oat straw $5, and corn silage $4.50 per ton.

Ewes' milk: Its fat content and relation to the growth of lambs, E. G. Ritzman (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 2, pp. 29–36, fig. 1*).—Data are reported on this subject from the New Hampshire Experiment Station, covering six distinct breeds and including native sheep and 11 types of first-generation crosses of sheep which may be considered as nonmilk breeds.

The fat content of 158 samples of ewes' milk taken at approximately one month after lambing varied from 2.4 to 12.1 per cent, the average being 6 per cent. Averages are given for the breeds and crosses for different age periods. These averages are practically equal for any age period from two to seven years, varying from 5.3 per cent at seven years to 6.38 per cent at five years. Wide variation was found in the fat content of samples of milk from the first, second, and third lactation periods of individual ewes. The average fat content of all the samples from 46 ewes was for the first year 5.67 per cent, second year 6.03 per cent, and third year 5.81 per cent.

A study was made of the growth of suckling lambs of 138 ewes whose milk varied in fat content from 2 to 10 per cent. The highest gains, 37 lbs., were made from milk testing from 2 to 3 per cent fat and the lowest gains, 18 lbs., from milk testing 10 per cent or over. On elimination of these extreme cases the fluctuation in weight increase bore no relation to the fat content of the milk. The limiting factor for growth in these tests was apparently the quantity of milk. Based on close observation, verified by the actual amounts of milk drawn for the determintion of fat, these 138 ewes were classified according to milk yield as high, good, fair, and poor. The average weights of the lambs of these classes were at 4 weeks 14.7, 13.4, 10.8, and 8 lbs.; at 8 weeks 34, 29.3, 24.6, and 19 lbs.; at 12 weeks 50.2, 43.3, 35.4, and 30 lbs.; and at 16 weeks 60.7, 55.3, 45.4, and 39 lbs., respectively. All the lambs had free access to a liberal amount of grain and hay which they ate greedily after they were about 8 weeks of age.

A list of the literature cited is given.

Feeding pure-bred draft fillies, J. L. Edmonds (*Illinois Sta. Bul. 192 (1916), pp. 426–448, figs. 18*).—In this experiment 10 pure-bred Percheron fillies were fed from weanlings to two years of age to determine the efficiency of alfalfa hay, corn, and oats. The experiment began December 8, 1914, and ended when the fillies were turned on pasture May 8, 1916, thus covering two winter and one summer feeding periods. Oats and corn were fed, one-half of each by weight, with alfalfa hay as the sole roughage. During the first winter the oats and corn were ground, and after that whole oats and shelled corn were fed. The pasture was a blue-grass sod, containing a slight mixture of other grasses. Analyses are given of the grain and hay used in the experiment.

Except during the first 28 days, when the fillies were allowed as much grain and hay as they would consume, the grain was restricted in amount so that the hay eaten amounted to 1 lb. or more daily per 100 lbs. of live weight.

The results indicated that a liberal proportion of well-cured legume hay should be the foundation for feeding young growing horses, and that enough grain should be fed to produce good growth. It is also indicated that as the individual becomes older the proportion of grain to hay may be decreased and still obtain good gains. In this experiment 0.5 lb. of grain daily per 100 lbs. of live weight was sufficient for proper development except for a short time when the pasturage was scant.

The average daily gain per head during the first winter was 1.94 lbs., during the summer 0.85 lb., and during the second winter 1.22 lbs., or 1.33 lbs. for the 518 days. The total gain per head was 690.5 lbs. and the average increase in height 7.96 in. The average total feed consumed during the whole experiment was 45.35 bu. of corn, 79.36 bu. of oats, 2.58 tons of alfalfa, and 0.8 acre of pasture per head. The average amount of feed required to produce a pound of gain was during the first winter 5.67 lbs. of grain and 4.27 lbs. of hay, and during the second winter 9.23 lbs. of grain and 13 lbs. of hay. The average weight of the fillies at one year was 1,112 lbs. and at two years 1,548 lbs.

On the basis of $11 per ton for alfalfa hay, 50 cts. per bushel for corn, 35 cts. per bushel for oats, and $10 per acre for pasture, the cost per pound of gain was 7.98 cts. for the first winter, 16.04 cts. for the summer, and 16.31 cts. for the second winter. On the same price basis the average total cost of feed per head was $56.07 for the year and $86.88 for the year and five months.

Fourth annual international egg laying contest, W. F. Kirkpatrick and L. E. Card (*Connecticut Storrs Sta. Bul. 87 (1916), pp. 197–244, figs. 25*).—In experimental pens in connection with this contest skim milk was substituted for the beef and fish scrap in the regular ration. Fifty hens on the regular ration laid 7,380 eggs and 50 hens on the milk ration laid 8,359 eggs. The milk-fed hens consumed 2,000 qt. of milk, valued at $20, and those on the regular ration about 350 lbs. of beef and fish scrap, at a cost of $9.

In the main contest the Rhode Island Red eggs averaged 1.6 lbs. per dozen, Plymouth Rock eggs 1.56 lbs., White Leghorn eggs 1.52 lbs., Wyandotte eggs 1.47 lbs., and miscellaneous breeds, including Light Brahmas, American Dominiques, Brown, Buff, and Black Leghorns, Silver Campines, Light Sussex, Salmon Faverolles, White Orpingtons, and Buttercups, 1.56 lbs. The average weight of the eggs for all of the breeds was 1.54 lbs. per dozen. The percentages of broody hens averaged from 5.9 for the White Leghorns to 69.6 for the Wyandottes, the average for all breeds being 37.2. The average number of days lost each broody period was 20.6. The number of eggs laid per month by the 1,000 hens in this contest varied from 4,070 in November to 18,280 in May. Over 34 per cent of the total eggs for the year were produced in March, April, and May.

In the operation of trap nests the number of eggs laid outside the nests varied from 8 in a pen of Orpingtons to 140 in a pen of Wyandottes, the average percentage of unidentified eggs for all the breeds being 3.73. Weight curves showed that all breeds were heaviest on March 1, and, with the exception of the first weighing on November 1, they were lightest on May 1.

The 1,820 birds involved in the third (E. S. R., 33, p. 672) and the fourth contests consumed an annual average of 44.4 lbs. of grain per hen or about 2 oz. per day. The feed cost per dozen eggs in the fourth contest was 12.7 cts. for the Leghorns, 12.9 cts. for the Wyandottes, 15.3 cts. for the Rhode Island Reds, and 16.2 cts. for the Plymouth Rocks, the average for all breeds being

14 cts. per dozen. In this contest it required an average of 4.27 lbs. of mash and grain to produce 1 lb. of eggs. Data with reference to egg production, feed, temperature, etc., are tabulated.

How to operate an incubator, J. E. DOUGHERTY (*California Sta. Circ. 156 (1916), pp. 8, figs. 3*).—Detailed directions are given.

DAIRY FARMING—DAIRYING.

Journal of the British Dairy Farmers' Association (*Jour. Brit. Dairy Farmers' Assoc., 30 (1916), pp. 257, figs. 7*).—This contains articles by various authors on milk recording in Great Britain, milk substitutes for calves, dairying of the future, dairying in New Zealand, fluctuations in the fat content of milk, the world's progress in dairying, the milking trials of 1915, and other dairying topics.

Twenty-sixth, twenty-seventh, twenty-eighth, and twenty-ninth annual reports of the Bernese Dairy School at Rütti-Zollikofen, A. PETER ET AL. (*Jahresber. Molk. Schule Rütti-Zollikofen, 26 (1912–13), pp. 70, pl. 1; 27 (1913–14), pp. 58, pl. 1, figs. 3; 28 (1914–15), pp. 100, pl. 1; 29 (1915–16), pp. 88, figs. 7*).—These are the usual reports (E. S. R., 28, p. 372).

The first-named also includes a discussion of the preparation of rennet, analytical data on the examination of milk by determination of the refractive index, analytical data obtained by the examination of milk by determining the specific gravity of the calcium chlorid serum, and the results of tests of a number of mechanical appliances.

The second report gives the results of some tests with a mechanical butter machine, a practical cheese test with a commercial coagulant, the use of fish meal as a feed for swine in conjunction with dairy waste, and the separation of cream by centrifugation.

The third report contains experimental results on the use of aluminum containers and the calculation of the food value of dairy waste in the feeding of swine.

The last report contains experimental work on the detection of milk adulteration by watering and analysis of butter and the results of tests of a number of mechanical appliances used in the dairy industry.

Experiments in the feeding of dairy cows, J. DUNLOP and P. W. BAILEY (*Midland Agr. and Dairy Col., Rpt. Expts. Feeding Dairy Cows [1916], pp. 16*).—In each of the three experiments here reported, each of which lasted for six weeks, eight Shorthorn cows were fed by the reversal system. The first and fourth weeks of each experiment were allowed for the cows to become accustomed to the rations.

In a comparison of hemp-seed cake and linseed cake the cows were fed a basal ration of cabbage, hay, straw, mixed grain, and Egyptian cotton-seed cake. In addition they received either 4 lbs. of linseed cake or 4 lbs. of hemp-seed cake per head daily. During the four weeks of the experiment proper the cows on linseed meal gained 58 lbs. in weight and produced 2,043.5 lbs. of milk, containing 3.8 per cent of fat. On hemp-seed meal they gained 4 lbs. in weight and produced 2,073 lbs. of milk, containing 3.75 per cent of fat. There was no difference in churnability of the milk or in flavor of the butter in favor of either of the rations. The hemp-seed cake had a slightly constipating effect upon the cows.

In a test comparing dried yeast with decorticated cotton-seed meal the cows were fed the same basal ration as in the above test and in addition either 3 lbs. of dried yeast or 3 lbs. of decorticated cotton-seed meal per head daily. On the dried yeast ration the cows gained 56 lbs. in weight and produced

2,954.75 lbs. of milk containing 3.77 per cent of fat. On the cotton-seed meal ration they gained 120 lbs. in weight and produced 2,913.5 lbs. of milk containing 3.72 per cent of fat. There was no difference in churnability of the milk or in flavor and quantity of the butter in favor of either of the rations, except that the butter made during the feeding of cotton-seed meal was the harder and of a better color.

In a test comparing decorticated peanut cake with decorticated cottonseed cake the cows were fed a basal ration of mangels, hay, bran, and dried yeast, and in addition either 4 lbs. of peanut cake or 4 lbs. of cottonseed cake. On peanut cake the cows lost 51 lbs. in weight and produced 3,504.25 lbs. of milk containing 3.86 per cent of fat; and on cottonseed cake they gained 111 lbs. in weight and produced 3,437.25 lbs. of milk containing 3.97 per cent of fat. There was no difference in quality or flavor of the butter from either of the rations, except that the butter churned during the peanut ration period was the softer.

Analyses of each of the concentrates compared in these tests are given.

The raising of dairy heifers, R. R. Kerr (*Jour. Dept. Agr. Victoria, 14 (1916), No. 7, pp. 385–397, figs. 6*).—In addition to general directions for and notes on raising dairy heifers, results are given of tests of heifers conducted by the government in Victoria. It is stated that the results of these tests are showing not only the value of breeding and care of animals and their productive qualities, but are furnishing the basis for a list of sires showing consistent dairy heredity.

Dairying in Uruguay, A. Abella (*Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 5, pp. 629–637*).—Brief data are given on the number of dairy cattle, milk production and consumption, butter and cheese making, the importation of dairy products, dairy regulations, and cooperation in milk production in Uruguay.

The milk problem, J. J. Dillon (*[Utica, N. Y.: Dairymen's League], 1916, pp. 16.*)—This is an address delivered at Utica, N. Y., on September 16, 1916, on the economic conditions surrounding the sale and distribution of milk in New York City and State.

The milk supply of Paris by producers' associations, M. Donon (*L'approvisionnement en Lait de la Ville de Paris par les Associations de Producteurs. Orléans: Imprimerie Orléanaise, 1914, pp. 170, figs. 29*).—This manual deals briefly with the milk supply and consumption of Paris, the price of milk to producers, conditions governing the sale of milk, milk syndicates, the organization and operation of cooperative dairies, and the production of hygienic milk. Appendixes give model constitutions of milk syndicates and cooperative dairies, rules governing the collecting of milk, estimates and specifications for the installation of equipment for cooperative dairies, and illustrations of plans and machinery.

[Proceedings ninth and tenth annual conferences of the American Association of Medical Milk Commissions, 1915 and 1916] (*Proc. Amer. Assoc. Med. Milk Com., 9 (1915), pp. 210; 10 (1916), pp. 256*).—These reports give, respectively, the proceedings of the ninth annual conference of this association, held at San Francisco, Cal., June 17–19, 1915, and the tenth annual conference, held at Cincinnati, Ohio, June 9–11, 1916. Reports of various medical milk commissions, the constitution and by-laws of the association, a list of medical milk commissions in the United States and Canada, and papers by various authors on the production of sanitary milk are included. The proceedings for the tenth conference also contain methods and standards for the production and distribution of certified milk.

Bacteriological examination of the Bombay milk supply, L. L. Joshi (*Jour. Dairying* [*India*], *3* (*1915*), *No. 1, pp. 5–36, fig. 1*).—This paper discusses the sources of bacteria in milk, factors influencing the multiplication of bacteria in milk, tubercle bacilli in milk, bacterial standards for milk in India, and methods and results of the bacteriological examination of a number of samples of buffaloes' and cows' milk from various sources in Bombay.

The average number of bacteria in 240 samples of milk bought at random from dairies, milk shops, cattle stables, railway stations, individual milk vendors, etc., in Bombay from April, 1913, to July, 1914, was 36,385,000 per cubic centimeter. A number of samples of milk collected under strict precautions from healthy cows and buffaloes and examined immediately gave an average bacteria count of 292 per cubic centimeter, and the tests for lactose fermenters and pathogenic microbes were negative in all cases. Out of 741 samples of Bombay milk examined during four years no tubercle bacilli were found. These results have since been confirmed at the Bombay bacteriological laboratory and the author concludes that tuberculosis is rarely, if at all, conveyed by milk in India.

Essentials for the production of clean milk, W. J. Dougan (*Hoard's Dairyman, 1916, Dec. 22, pp. 757, 788, figs. 6*).—This is a brief discussion of the essentials for the production of high-class milk at reasonable prices.

Cooling milk on the farm, H. F. Judkins (*Conn. Agr. Col. Ext. Serv. Bul. 1* (*1916*), *pp. 18, figs. 4*).—General directions are given for cooling milk on the farm, including the use of the cooling tank, milk coolers, and mechanical refrigeration, and the cooling of bottled milk.

Some aspects of the physiology of milk secretion, R. L. Hill (*Jour. Amer. Vet. Med. Assoc., 49* (*1916*), *No. 4, pp. 483–510*).—This is a brief survey of the theories and scientific investigations upon this subject, and an account of recent experiments upon the increase of milk secretion due to the injection of substances present in the pituitary body. A list of the literature reviewed is given.

Rapid method of counting bacteria in milk, W. D. Frost (*Science, n. ser., 42* (*1915*), *No. 1077, pp. 255, 256*).—This outlines a rapid method of counting bacteria in milk described below.

A rapid method of counting living bacteria in milk and other richly seeded materials, W. D. Frost (*Jour. Amer. Med. Assoc., 66* (*1916*), *No. 12, pp. 889, 890, figs. 5*).—This paper describes in detail the method noted in the preceding abstract. In brief the method is as follows:

One-twentieth cc. of milk is mixed with standard nutrient agar and spread over a definite area of a sterile glass slide. When the agar is hard, this little plate culture is put in the incubator for about six hours under conditions which prevent evaporation. It is then dried, given a preliminary treatment to prevent the agar from firmly binding the stain, stained, decolorized, and cleared. When this dried and stained plate culture is viewed under the microscope, the little colonies are definitely stained and appear highly colored on a colorless or silghtly colored background. These colonies can be readily counted and the number of bacteria per cubic centimeter calculated.

The author states that this method can be used for pasteurized milk, but in case of recently pasteurized and very good milks the time required for incubating the plates will probably be from 8 to 12 hours.

Counting bacteria in milk in less than eight hours, W. D. Frost (*Milk Dealer, 6* (*1916*), *No. 3, pp. 24–32, 34, 36, figs. 11*).—The author reviews the various attempts that have been made to devise a method for the bacteriological examination of milk in a shorter time than that required for the plate method, and gives results obtained by the method noted above. Charts are also given of a number of series of comparative tests showing the variation in bacteria

counts of samples of milk by the rapid method and by the standard plate method.

In one series the ratio of the standard plate counts to the rapid plate counts varied from 1:0.05 to 1:7.43 with an average of 1:0.96. In nearly two-thirds of the counts the rapid method gave a lower count than the standard method. In another series the ratio varied from 1:0.02 to 1:2.8 with an average of 1:1.17. Tests by other experimenters are reviewed which show that variations occurring between duplicate plates or between different dilutions in the same sample by the ordinary plate method are often as great as the above.

A brief description is also given of a microscopic test for pasteurized milk which has been noted from another source (E. S. R., 34, p. 113), and results obtained with about 500 samples of milk tested by this method are noted. The author claims that by this method not only freshly pasteurized milk but pasteurized milk that has become recontaminated can be readily detected.

A list of cited literature is given.

Comparison of a rapid method of counting bacteria in milk with the standard plate method, W. D. Frost (*Jour. Infect. Diseases, 19 (1916), No. 3, pp. 273–287, figs. 6*).—The method here described and the data reported have been noted from another source (see above).

Points in butter factory management under home separation, G. M. Valentine (*Jour. Agr. [New Zeal.], 13 (1916), No. 1, pp. 17–25*).—This paper deals with the problems that arise in the management of gathered-cream butter factories, including weighing, sampling, and testing cream; neutralizing and pasteurizing; cooling and refrigeration; power; churning and moisture testing; and the keeping of records.

A practical guide for the manufacture of butter and cheese, A. De Toth (*Guia Practica de la Fabricacion de Mantequilla y Quesos. [Mexico City]: Sec. Fomento, Colon. e Indus., 1916, pp. 164, figs. 65*).—General directions are given for making cheese and butter under Mexico conditions.

Various experiments in making Cheddar cheese, L. Bibeau (*Rpt. Dairymen's Asso. Prov. Quebec, 34 (1915), pp. 222–230*).—Brief results are given of cheese making experiments conducted by the author at various dairy schools and cheese factories in Quebec during 1914 and 1915.

VETERINARY MEDICINE.

Practical bacteriology, blood work, and animal parasitology, E. R. Stitt (*Philadelphia: P. Blakiston's Son & Co., 1916, 4. ed., rev. and enl., pp. XVII+497, figs. 119*).—This is the fourth edition of the work previously noted (E. S. R., 26, p. 174). Because of the rapid advances in the subject practically every chapter has been revised and new material added. Portions of some chapters have been entirely rewritten. A new chapter dealing with diseases of unknown or doubtful origin has been added, in which is discussed the vitamin theory in beriberi and pellagra, as well as recent findings in typhus fever, rat-bite fever, Rocky Mountain spotted fever, etc.

Bacteriological keys, zoological tables, explanatory clinical notes, and an appendix giving directions for the preparation of tissues for examination in microscopic sections, the mounting and preservation of animal parasites, the preparation of normal solutions, and the chemical examination of blood, urine, gastric contents, and duodenal fluid, and a brief discussion of disinfectants and insecticides are included.

The packing for shipment of meat samples for bacteriological examination, L. Filenski (*Arb. K. Gsndhtsamt., 50 (1915), No. 1, pp. 133–148*).—Data submitted show that meat samples to be sent for bacteriological examination

can be satisfactorily packed in bran. For larger samples wrapping in cotton cloth previously soaked in alcohol is recommended. The use of vinegar, mercuric chlorid, pickling solutions, borax, and bleaching powder is not recommended as practical, although in isolated cases the experimental results obtained were satisfactory.

Serums, vaccines, and toxins in treatment and diagnosis, W. C. BOSANQUET and J. W. H. EYRE (*New York: Funk & Wagnalls Co., 1916, 3. ed., pp. VIII+456, figs. 20*).—This volume discusses the subject under the general topics of immunity and resistance to disease, preparation and administration of sera and bacterial vaccines, sera and toxins in diagnosis, diphtheria, tetanus, snake bite, hydrophobia, smallpox and vaccinia, anthrax and glanders, plague, cholera, enteric fever, dysentery and other bacillary infections, tuberculosis, leprosy, affections due to streptococci, other infections due to cocci, catarrhal affections, diseases due to protozoa, and malignant tumors. An appendix on various conditions treated with sera is included.

Digested and diluted serum as a substitute for broth for bacteriological purposes, A. DISTASO (*Brit. Med. Jour., No. 2912 (1916), pp. 555, 556*).—The author describes the preparation of a culture medium from sheep or ox serum by digestion overnight with an aqueous extract of pig's pancreas previously activated with an aqueous extract of a small portion of the duodenum of the pig.

A luxuriant growth of the *Bacillus coli* group, streptococcus, staphylococcus, *B. subtilis*, *B. proteus*, and *B. fluorescens* was obtained on the medium. Little or no growth of meningococci was obtained, however.

For indol formation the medium yielded the same results as the usual tryptophane medium. The medium is also suited for sugar tests and by combining with agar can be used to produce a beautiful transparent solid medium.

Directions for the preparation of the diluted serum for sugar tests are also submitted. This medium is especially suitable for *B. coli* and is much cheaper than those commonly used.

The effects of serum treated with agar, E. ZUNZ and M. GELAT (*Jour. Expt. Med., 24 (1916), No. 3, pp. 247–269*).—Experiments reported in detail show that the intravenous injection into normal rabbits of horse serum, previously kept for two hours at 38° C. in the presence of 0.2 of its volume of a 0.5 per cent suspension of agar in physiological saline and then separated from the agar by centrifugalization and filtration, produces a considerable and prolonged fall in blood pressure, expulsion of feces, diminished coagulability in the carotid blood, and, at times, accelerated respiration. The various symptoms produced are the same as those observed after the intravenous injection of horse serum into a previously sensitized rabbit.

Horse serum previously kept for 30 minutes at 56°, and then treated with agar as described, produces no other effect than does the ordinary introduction of horse serum into the veins of a normal rabbit.

The experimental results are discussed in some detail.

The effect of moderately high atmospheric temperatures upon the formation of agglutinins, C. E. A. WINSLOW, J. A. MILLER, and W. C. NOBLE (*Proc. Soc. Expt. Biol. and Med., 13 (1916), No. 8, pp. 194–197*).—The results of experiments reported, in which animals were immunized by successive intraperitoneal injections of increasing doses of killed typhoid bacilli and kept at temperatures ranging from 29 to 32° C., indicate that the moderately high temperatures tend to lower the power of agglutinin formation in rabbits.

Immunity produced by intravascular injections, L. CAMUS (*Compt. Rend. Acad. Sci. [Paris], 163 (1916), No. 14, pp. 338–340*).—Experiments are reported which show that the time necessary for immunization varies with the dose of vaccine employed. It is not possible, as some have supposed, to suppress the

latent phase (incubation period), but the time can be controlled by increasing or decreasing the quantity of vaccine used. The importance of individual variation in the production of immunity is noted.

Studies on antibodies.—I, Analyses and nitrogen distribution of a number of antisera, E. J. BANZHAF, K. SUGIURA, and K. G. FALK (*Jour. Immunol., 2 (1916), No. 1, pp. 125–135*).—This material has been previously noted (E. S. R., 36, p. 80).

Experiments with oil of Chenopodium and cardiac stimulants on the isolated frog heart, W. SALANT and A. E. LIVINGSTON (*Amer. Jour. Physiol., 41 (1916), No. 1, pp. 21–38, figs. 10*).

A further report on thromboplastin solution as a hemostatic, A. F. HESS (*Jour. Amer. Med. Assoc., 67 (1916), No. 24, pp. 1717–1720*).—A number of cases are reported in which an aqueous extract of ox brain was successfully used.

It is concluded that the thromboplastin is of practical value in controlling hemorrhage wherever it can reach the site of bleeding. In cases of true hemophilia it may be regarded almost as a specific hemostatic. Its use is indicated in a variety of hemorrhages. In cases where local applications fail the thromboplastin solution should be injected into the site of hemorrhage. This procedure can be readily resorted to as the solution loses little of its potency as the result of dilution and rapid boiling.

In addition to its hemostatic action the extract was found to possess healing properties, actively stimulating granulation and hastening epithelization.

Spontaneous amebic dysentery in monkeys, A. EICHHORN and B. GALLAGHER (*Jour. Infect. Diseases, 19 (1916), No. 3, pp. 395–407, figs. 5*).—This paper reports upon a spontaneous outbreak of a disease in monkeys in which the lesions corresponded closely to those found in amebic or tropical dysentery in man, and in which protozoal organisms occurred that had the structure and characteristics of those amebas generally considered the causative agents in human tropical dysentery.

The presence of Bacillus typhosus in the blood of rabbits after inoculation into the gall bladder, LANGE and ROOS (*Arb. K. Gsndhtsamt., 50 (1915), No. 1, pp. 57–95*).—In a very short time after inoculation of typhoid bacilli into the gall bladder of rabbits the presence of the organisms can be detected in the blood of the ear vein. This migration takes place directly at the point of inoculation or in the immediate tissue through the blood capillaries of the gall bladder. Such a rapid migration does not take place from other organs which are equally as rich in capillaries. Injection of bile into the gall bladder facilitates the migration, while the subcutaneous injection inhibits it. By direct injection into the liver a similar migration takes place. The animals which have been inoculated in the gall bladder with the organisms become carriers of the organisms, whether the migration was slow or rapid. Where the gall bladder was extirpated shortly after the inoculation (six minutes) the animals did not become carriers.

In one animal typhoid bacilli were found in the urine 20 minutes after inoculation.

The etiology of Rocky Mountain spotted fever, S. B. WOLBACH (*Jour. Med. Research, 34 (1916), No. 1, pp. 121–126, pl. 1*).—The author reports the occurrence of a bacterium in large numbers in the lesions characteristic of spotted fever in experimental animals. "The organism corresponds in some respects with the description given by Ricketts of bodies which he found in the blood of human and experimental cases, and in the tissues and eggs of infected ticks. The classification of the organisms is not yet clear; of its bacillary form and multiplication by transverse division there can be no question."

The etiology of Rocky Mountain spotted fever.—Occurrence of the parasite in the tick, S. B. WOLBACH (*Jour. Med. Research, 35 (1916), No. 158, pp. 147–150*).—"A parasite has been found in proved infected ticks in large numbers, morphologically identical with the parasite found in the lesions of guinea pigs and monkeys infected with Rocky Mountain spotted fever. This parasite does not occur in the tissues of ticks proved to be noninfective.

"The distribution of the parasite in the infected ticks indicates that the transmission occurs by way of the salivary gland secretions. Transmission by fecal contamination of the wound caused by the tick does not seem possible because of the character of the tick's feces."

Equine and bovine streptococci as causal agents of human infections, A. J. CHALMERS and A. MARSHALL (*Jour. Trop. Med. and Hyg. [London], 19 (1916), Nos. 18, pp. 213–215; 19, pp. 225–228*).—The authors here attempt to trace the pathogenic streptococci found in puerperal fever and in sore throats to their sources.

The occurrence in the United States of certain nematodes of ruminants transmissible to man, B. H. RANSOM (*New Orleans Med. and Surg. Jour., 69 (1916), No. 4, pp. 294–298*).—In this article the author calls attention to the occurrence in this country of three of the four species of Trichostrongylus which have been recorded as parasites of man, namely, *T. colubriformis*, *T. vitrinus*, and *T. probolurus*, reference to which has previously been noted (E. S. R., 25, p. 387).

Some notes on the encysted larva of the lung distome, S. YOSHIDA (*Jour. Parasitology, 2 (1916), No. 4, pp. 175–180, fig. 1*).—This further paper on the subject (E. S. R., 35, p. 384) reports some of the results obtained in a subsequent study on the cysts of the lung distome in crabs, especially *Eriocheir japonicus*.

Immunity studies on anthrax serum, A. EICHHORN, W. N. BERG, and R. A. KELSER (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 2, pp. 37–56, fig. 1*).—The authors have fractionated anthrax serum obtained by the hyperimmunization technique previously described by the senior author (E. S. R., 34, p. 579) by the methods commonly used in the fractionation of diphtheria antitoxin. The anthrax antibodies were found in the pseudoglobulin fraction. The globulin preparations contained the antibodies in a concentrated form, as shown by numerous tests on laboratory animals. Tests on larger animals also proved the presence of antibodies in this preparation. Preliminary data obtained from the use of the serum and globulin in the treatment of anthrax in man showed it to yield very satisfactory results.

The methods of analysis of serum and similar preparations with some slight modifications and improvements are described in detail. For the separation of globulin precipitates from their filtrates centrifugalization has been found to be more effective and rapid than filtration.

Experiments to determine the changes in the serum proteins during immunization (mule) showed a pronounced rise in the content of total coagulable protein and total globulin, as has been noted by other investigators immunizing against diphtheria, tetanus, and rinderpest virus.

The value of a preparation as described, in that a much smaller dose is required which may be safely inoculated intravenously and also as minimizing the danger of anaphylactic shock, is pointed out. The complement-fixation test has been applied to the standardization of the anthrax serum, and while it is considered still to be in an experimental stage its value as an accurate method of standardization is indicated.

The analytical and immunization data are submitted in tabular and graphical form.

Simultaneous vaccination against blackleg, F. S. Schoenleber (*Amer. Jour. Vet. Med., 11 (1916), No. 10, pp. 796, 797*).—The use of a blackleg serum (filtered sterile serum of highly immunized animals) on 2,500 head of calves with practically no loss is reported. The serum is said to have not only protected the animals against the disease but checked it when given in the early stages. The immunity, however, lasts only a few days, so that the administration of the serum must be followed by an inoculation of the virus. As much as 300 cc. has been introduced intramuscularly into one animal without any serious effects.

Serological investigational methods as aids in the diagnosis of trypanosome diseases, with special reference to dourine, R. Offermann (*Arb. K. Gsndhtsamt., 50 (1915), No. 1, pp. 1–30*).—The results of the study reported show that sera obtained from healthy rabbits in many cases were antihemolytic. The regularity of the occurrence of this antihemolytic property could not be established. In the use of rabbit serum in complement-fixation tests it is indicated that the serum should be tested before inoculation.

Agglutinins which will agglutinate the trypanosomes of dourine were not found in normal rabbit serum. Complement-binding antibodies and agglutinins, however, were found in the sera of rabbits which had previously been inoculated with the trypanosomes. The antibodies did not always appear simultaneously. In general, complement-binding amboceptors were detected earlier than agglutinins. The time of appearance and quantity of antibodies varied with the individual animals and with the course of the disease. The quantity diminished somewhat in the course of the disease but increased again in time. No regularity of this phenomenon could be established. In no case did they disappear completely from the blood stream.

Antibodies could be detected in the serum kept under sterile conditions after many months.

For agglutination it is stated that a fresh suspension of trypanosomes must be used. The antigen used for complement fixation was found to retain its activity for many weeks if kept in a refrigerator.

Complement fixation and agglutination are considered to be valuable diagnostic aids. Since complement fixation yields more satisfactory results it is to be preferred.

Foot-and-mouth disease, A. Vrijburg (*Tijdschr. Diergeneesk., 43 (1916), No. 22, pp. 847–865*).—This discusses the subject under the topics of virus; virus carriers; spread of the disease through negligence in handling diseased animals and carcasses, through wild animals, insects, wind, waterfowl, etc.; clinical symptoms; severe forms of the disease; differential diagnosis; susceptibility; immunity; sanitary and hygienic measures; immune serum; immunization with attenuated virus; and simultaneous treatment.

Foot-and-mouth disease, E. M. Mulder (*Tijdschr. Diergeneesk., 43 (1916), No. 22, pp. 838–847*).—This is a general discussion of the disease from the standpoint of control and eradication.

The author considers that the virus of the disease produces a lasting immunity in the animals, as is evidenced by the natural immunity of the offspring. A system of immunization of all male animals which are to be used for breeding purposes is outlined and is considered to be the most rational method for eradicating the disease.

Foot-and-mouth disease in Friesland, H. Van Staa (*Tijdschr. Diergeneesk., 43 (1916), No. 22, pp. 825–837, figs. 2*).—This is a general review and discussion of the outbreaks of the disease from 1891 through 1915.

The data presented show that the outbreaks of the disease during the months of October, November, December, January, February, and March were twice as

great as during the remaining or summer months. The virus of the disease is believed to have been introduced, even from the first outbreak, by infected waterfowl, which come into the country from the east in the fall of the year.

It is indicated that more infectious diseases are carried by birds than is usually considered.

Old and new methods for the diagnosis of glanders, E. Gräub (*Schweiz. Arch. Tierheilk., 58 (1916), No. 11, pp. 579–595, figs. 2*).—This is a general discussion of the various biological methods used in the diagnosis of glanders.

The conglutination reaction is described and discussed in some detail.

Diagnosis of tuberculosis by complement fixation, with special reference to bovine tuberculosis, A. Eichhorn and A. Blumberg (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 1, pp. 1–20, fig. 1*).—A brief historical résumé is given and the preparation of antigens and data obtained in their standardization submitted. An antigen prepared with bacillary emulsion and tuberculin precipitate was found to be the most effective in the serological tests.

From data obtained with the use of these antigens with 816 bovine, 120 porcine, and 22 human sera, it is concluded that the complement-fixation test in cattle is not so reliable as the subcutaneous tuberculin test. Since a large proportion of the positive cases give only a faint reaction, a very careful titration of the antigen and a most accurate observance of all the details of the technique of the test are necessary. The degree of the reaction could not be considered as an index to the extent of infection. It is thought that the test could be employed as a supplementary test in cases of doubtful or atypical reactions to the subcutaneous or other allergic tests, but it is not deemed practical for general diagnostic purposes.

The results of the test are affected by subcutaneous injection of tuberculin into healthy animals. This interference may be noted as early as the fourth day following the injection, and may persist for six weeks, or possibly for a much longer time.

A list of 43 references of cited literature is appended.

The diagnosis of tuberculosis with special reference to the intrapalpebral test, N. Mori (*Ann. Staz. Sper. Malattie Infet. Bestiame, R. Ist. Incoragg. Napoli, 2 (1914), No. 2, pp. 289–317*).—Experimental data obtained by the use of the various procedures for the introduction of tuberculin into suspected animals (bovines) are reported in detail and discussed.

It is concluded that the intrapalpebral test is a reliable and easily manipulated procedure for the diagnosis of tuberculosis, especially in general practice.

Transmission of porcine tuberculosis to man and the reinoculation of calves, H. Markus (*Rev. Gén. Méd. Vét., 25 (1916), No. 298, pp. 466–478, figs. 3*).—The case of a veterinarian infected with the tubercle bacillus through a small abrasion on the thumb during the examination of a large number of tuberculous hogs is reported.

The micro-organism was isolated from the wound and after cultivation injected into calves. The disease was produced in all cases and the diagnosis substantiated by post-mortem findings. The bacteriological, histological, and autopsical findings are described.

It is indicated that the case demonstrates that the bacillus of Koch coming from the hog is equally pathogenic for the human organism.

Bovine tuberculosis, J. G. Wills and C. Linch (*N. Y. Dept. Agr. Bul. 82 (1916), pp. 1875–1956, figs. 34*).—This bulletin discusses the subject under the general topics of tuberculosis and its development, dissemination of tuberculosis, tuberculosis in calves, tuberculin, reactions, physical examinations, pasteurization, and methods of control. A glossary of terms relating to the subject is included.

Cases of poisoning in cattle by feeding on meal from soy bean after extraction of the oil, S. Stockman (*Jour. Compar. Path. and Ther., 29* (*1916*), *No. 2, pp. 95–107*).—A report of deaths among cows receiving a ration of soy bean meal or cake in a district in the south of Scotland in which 54 of 67 affected cows on nine different farms died led to an investigation of the cause. The symptoms and post-mortem appearances are described and data collected on eight of the farms are reported in tabular form. With these data as a basis, laboratory feeding experiments were conducted with cattle and other animals and are here reported.

The feeding of extracted soy cake and meal produced symptoms and post-mortem lesions which were identical with those occurring in the field among cattle fed on similar material. The extracted soy in no case, in practice or laboratory, produced a sudden effect, considerable amounts being consumed and a considerable time elapsing before signs of illness appeared. The smallest amount consumed at the laboratory before the disease appeared was 172 lbs. in 36 days. The shortest time in which the disease appeared was 29 days, during which period 201 lbs. were fed. No animal other than cattle suffered from feeding on this meal or cake, either in practice or at the laboratory.

It is pointed out that the very high temperature (106 to 109° F.) accompanying the illness seems to exclude the ordinary poisons but does not exclude a poison of the ricin class. Specific bacterial infection was excluded by test inoculations, microscopical and bacteriological examinations, and by the sterilizing temperature which was used in the process of manufacture. No castor seeds could be traced in the meal.

A wide inquiry shows that the whole soy bean is not poisonous and an inquiry among manufacturers shows that there is plenty of evidence that soy extracted with naphtha does not cause poisoning; thus it appears that the trouble was caused by the use only of soy extracted with trichlorethylene, although this is not poisonous when given to cattle in from 1 to 3 oz. and for long periods. It is suggested (1) that the products from trichlorethylene obtained by heat may be poisonous, (2) that the trichlorethylene in contact with soy and heat to drive off the former may form a poison, or (3) that some of the trichlorethylene was impure and contained other bodies. Thus it is inadvisable to use trichlorethylene as an extractor.

A disease resembling "forage poisoning" in horses and mules wherein oat hay incorporated the primary factor, R. Graham, L. R. Himmelberger, and R. L. Pontius (*Rept. U. S. Live Stock Sanit. Assoc., 19* (*1915*), *pp. 22–42, figs. 2*).—Previously noted from another source (E. S. R., 34, p. 681). See also a note by Graham and Himmelberger (E. S. R., 36, p. 280).

Studies on forage poisoning, R. Graham and L. R. Himmelberger (*Jour. Infect. Diseases, 19* (*1916*), *No. 3, pp. 385–394, figs. 3*).—The first part of this paper (pp. 385–388), which deals with the pathologic changes in a disease in horses resembling forage poisoning, is based upon studies of tissues secured from seven horses fatally affected in consequence of feeding on an oat hay in the experiments above noted. "While the pathologic presentations in the various tissues examined are not diagnostic, since no pathognomonic importance can be ascribed to them, the changes found collectively are suggestive of a toxemialike condition in so far as the type of the disease we have studied is concerned."

The second part of the paper (pp. 388–394) relates to a pathogenic bacillus, isolated from the same oat hay as was the *Bacillus coli*-like organism above noted, which grew readily under laboratory conditions. Feeding and inoculation experiments indicate that the bacillus is nonpathogenic for rabbits, guinea pigs, white rats, chickens, cats, dogs, and swine. Horses, mules, cattle, sheep, and goats do not succumb to a single intravenous injection, except in rare instances,

but repeated daily injections in horses are followed by nervous manifestations, marasmus, coma, and death. "The symptoms observed in experimental horses following the injection of the sterile filtrate of this bacillus grown on Uschinsky's medium evidence the production of a toxinlike substance as an inherent character of the bacillus isolated from the oat hay, and the results from repeated administrations suggest a systemic cumulative action. Repeated intravenous injections of the bacillus washed from agar slants, sterile filtrates of the culture on Uschinsky's medium, broth cultures by way of the mouth or in the form of enemas produced variable nervous symptoms and death in horses and mules."

"A somewhat similar microorganism has been isolated from the chicken excreta found in the oat hay, but its pathogenicity has not yet been established. This micro-organism was not isolated from two apparently wholesome forages examined bacteriologically, but from sorghum silage obtained from a farm where animal fatalities had occurred with symptoms resembling forage poisoning, a micro-organism with somewhat similar cultural characteristics was obtained. The micro-organism from the sorghum silage possesses pathogenic properties, as observed following inoculation of experimental horses," and reported below.

Studies in forage poisoning, R. GRAHAM and L. R. HIMMELBERGER (*Jour. Compar. Path. and Ther., 29 (1916), No. 2, pp. 107–116*).—In continuation of the above studies, the authors report upon an outbreak in Woodford County, Ky., in December, 1915, in which losses occurred among young cattle fed grain rations and silage. The symptoms in these animals consisted of emaciation, dull languid appearance, incoordination in walking, loss of appetite, diarrhea, decubitus, temperature and respiration normal, and pulse weak. The feeding of the silage, which consisted of sorghum cut about one week before placing it in the silo in August, was discontinued, and no further losses occurred.

Fourteen experiments with animals, including cattle, horses, sheep, and goats, were made, in which feeding and inoculation tests were carried out with silage, watery extract of silage, cultures of the bacillus, and sterile filtrates from cultures. The bacillus isolated from the silage, but which could not be found in the station sorghum silage, possessed pathogenic properties for some of the experimental animals. "Daily administrations of sterile filtrates of this bacillus grown on a synthetic medium, introduced intrajugularly, and bouillon cultures in the form of enemas produced death in horses, as did also daily drenches of bouillon cultures to calves, with clinical manifestations and gross anatomical changes not unlike those observed in some cases of forage poisoning. The morphological and cultural features of this bacillus are in every major detail analogous to those possessed by a pathogenic organism isolated from an oat hay responsible for losses among horses and mules, as demonstrated by feeding experiments," as noted above.

The etiology of infectious anemia of the horse, CARRÉ and VALLÉE (*Rec. Méd. Vét., 92 (1916), No. 7, pp. 193–199; Ann. Inst. Pasteur, 30 (1916), No. 8, pp. 383–388; abs. in Trop. Vet. Bul., 4 (1916), No. 3, pp. 124, 125*).—This is a summary of work conducted by the authors during the past 12 years, with references to the work of others who have confirmed the authors' original findings incriminating an ultravisible virus as the cause of this disease. The authors refuse to admit the unicity of pernicious anemia of the horse and that the disease is only verminous in origin, as reported by Seyderhelm and Seyderhelm (E. S. R., 33, p. 681) and by Ries (E. S. R., 18, p. 584).

Report on the investigation into joint-ill in foals existing in the Province of Ontario, F. W. SCHOFIELD (*Toronto, Canada: Govt., 1915, pp. 16*).—This first report includes tables giving the bacteriological results in 23 cases of joint-ill and the results of vaccine treatment. A specially prepared bacterial vaccine containing *Staphylococcus aureus*, *Streptococcus* sp., and *Bacillus abortivus-*

equinus was tested in 170 cases and found to be followed by a decrease in the mortality of more than 50 per cent.

Second report on the investigation into joint-ill in foals existing in the Province of Ontario, F. W. SCHOFIELD (*Toronto, Canada: Govt., 1916, pp. 24, figs. 5*).—The investigations here reported, in continuation of those above noted, have led to the following conclusions:

"The disease joint-ill can be prevented in many cases by the use of a suitable prophylactic vaccine. The vaccine used in this experiment, while producing results that are far from ideal, was of definite prophylactic value. The treatment has no untoward effect upon the foal either immediate or delayed. The vaccine should be used in conjunction with the other prophylactic measures in combating this disease. . . . Better results are obtained from the use of vaccines in the treatment of joint-ill than from any other method of treatment. There is much room for improvement as the average mortality is still far in excess of what it should be. . . .

"A hemolytic streptococcus is apparently very closely related to the disease joint-ill. Marked pathogenicity for the rabbit is characteristic of the hemolytic streptococcus of joint-ill. In some of the most severe cases, no organisms could be isolated from the joint fluid or blood. Ingestion infection is quite probable since the presence of streptococci has been found in the milk of the dam identical with those recovered from the diseased joints of foals."

A nongas-producing strain of the hog-cholera bacillus isolated from an old laboratory culture, C. TENBROECK (*Jour. Expt. Med., 24 (1916), No. 3, pp. 213–222*).—"In a stock culture of the hog-cholera bacillus, which was passed through a series of rabbits 14 years ago, an organism was found that differs from the original culture in that it fails to form gas from the carbohydrates that are usually attacked by this organism, while acid formation persists. This new strain is agglutinated by an antihog-cholera bacillus serum, and produces in rabbits and mice a disease similar to that caused by the typical cultures. The failure to form gas has persisted over a period of 18 months, and all attempts to cause the strain to revert to the original condition have failed."

The organism resembles in many respects *Bacillus typhosus*. Attempts to produce a similar change in more recently isolated cultures by animal passages and changes in environment failed.

RURAL ENGINEERING.

Seventeenth biennial report of the state engineer, Colorado, 1913–14, (*Bien. Rpt. State Engin. Colo., 17 (1913–14), pts. 1, pp. 261, pl. 1; 2, pp. 350*).—This report includes data on the general irrigation situation in Colorado, including financial matters, gives abstracts of reports of the water commissioners, reports the results of numerous seepage investigations, and gives the results of measurements of flow made in the Arkansas, Grand, Laramie, Rio Grande, San Juan, South Platte, Yampa, and White river drainage basins.

Surface water supply of Pacific drainage basins in Washington and upper Columbia River basin, 1914 (*U. S. Geol. Survey, Water-Supply Paper 392 (1916), pp. 7–200, pls. 2*).—This report, prepared in cooperation with the States of Washington, Montana, and Idaho, contains the results of measurements of flow made on streams in the Puget Sound and the upper Columbia River drainage basins.

Profile surveys in Skagit River basin, Washington (*U. S. Geol. Survey, Water-Supply Paper 419 (1916), pp. 5–8, pls. 12*).—This report, prepared under the direction of W. H. Herron, contains a plan and profile of Skagit River and certain tributaries above Concrete, Wash., made from surveys in 1915.

Profile surveys along Henrys Fork, Idaho, and Logan River and Blacksmith Fork, Utah (*U. S. Geol. Survey, Water-Supply Paper 420 (1916), pp. 5–8, pls. 10*).—This report, prepared under the direction of W. H. Herron, describes the general features of the Snake River basin and the Logan River basin and gives plans and profiles of Henrys Fork above St. Anthony, of the outlet of Henrys Lake, Idaho, of Logan River above Logan, and of Blacksmith Fork, above Hyrum, Utah.

Profile surveys in 1915 along the Rio Grande, Pecos River, and Mora River, in New Mexico (*U. S. Geol. Survey, Water-Supply Paper 421 (1916), pp. 5–11, pls. 11*).—This report, prepared under the direction of W. H. Herron, contains plans and profiles from surveys made in 1915 of the Rio Grande in the vicinity of Buckman, N. Mex., and from Embudo, N. Mex., to the Colorado state line, of the Pecos River above Alexander Valle Grant, N. Mex., and of the Mora River from its mouth to the east boundary of Mora Grant, N. Mex.

Irrigation field laboratory at Denver, Colorado, R. B. SLEIGHT (*Engin. News, 76 (1916), No. 23, pp. 1080–1082, figs. 5*).—This laboratory, which is part of the equipment of the Irrigation Investigations Division of the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture, is described and some of the important features illustrated.

Concrete pipe irrigation systems (*Jour. Electricity, 37 (1916), No. 12, pp. 219–221, figs. 6*).—The manufacture of concrete pipe for use in irrigation distribution systems is discussed, and diagrams are given showing the carrying capacity in cubic feet per second, miners' inches, and gallons per minute of concrete pipe varying in diameter from 6 to 24 in. and with a slope varying from 0.5 to 30 ft. per 1,000 ft. The value of n in Kutter's formula used is 0.0135.

[Competitive tests of (commercial) overhead irrigation systems in 1914], E. KRÜGER and A. NACHTWEH (*Arb. Deut. Landw. Gesell., No. 276 (1915), pp. 87, figs. 55*).—This paper includes a general discussion of irrigation and irrigation systems and a description of overhead irrigation systems with prices. It also reports tests of four commercial types of overhead irrigation systems.

Malheur and Owyhee projects, irrigation and drainage, J. T. WHISTLER and J. H. LEWIS (*Oreg. Cooper. Work, Dept. Int. U. S. Reclamation Serv., 1916, Feb., pp. XII+13–201, pls. 52, fig. 1*).—This report, prepared in cooperation with the State of Oregon, gives the results of investigations for the irrigation from the Malheur River of Malheur Valley lands in the vicinity of Vale and Ontario, Oreg., and of lands in the vicinity of Nyssa from the Owyhee River.

"The Malheur project includes approximately 39,150 acres of irrigable land, of which approximately 31,600 acres are the first development and 7,550 acres a later extension of the first development. . . . The present plans are to use the river as the main distributary. . . .

"An agricultural and soil survey of the lands under the proposed project shows the fertility of the lands and at the same time the necessity for drainage. The long seasons and fertility of the soil make it capable of fairly intensive development. . . . The duty adopted for the gravity lands is 2.6 ft. in depth during the irrigating season; for the pump lands 2.1 ft. in depth for the season. The distribution losses are estimated at 20 per cent of the water taken out at the heads of the laterals. The seepage loss for earth sections is estimated at 1 ft. in depth per day over the wetted area of canals and for concrete lined canals 1 in. in depth. . . . The yearly diversion use for the development of the full project or 39,150 acres is 161,400 acre feet. . . . The reservoir capacity required is 159,000 acre-feet. . . . The total cost of the entire project, including drainage, is $1,438,458, an average cost of approximately $37 per acre. . . .

"The development proposed in the Owyhee Project is the irrigation of about 18,100 acres of land lying partly on both sides of Owyhee River in the vicinity of Mitchell Butte, and in addition the inclusion within the project of about 4,900 acres now served from the Ontario-Nyssa Canal (Shoestring Ditch), which derives its supply for irrigation use by pumping from Snake River. . . . A soil and agricultural survey of the area included within the project . . . shows that this area is capable of a fairly intensive cultivation and is as promising as any arid soil in the State which is susceptible of reclamation by irrigation. . . . The duty of water adopted for the lands of this project is 2.6 ft. in depth during the irrigating season for the lands under the main gravity canal on the north side of the river and on the lands served from the Ontario-Nyssa Canal. The corresponding duty for all the other lands of the project is 2.1 ft. in depth. Distribution losses are estimated at 20 per cent of the water delivered to the heads of laterals. Canal seepage losses from the heads of laterals to the diversion are estimated at 1 ft. in depth per day over the wetted canal area for unlined canal sections, and similarly 1 in. in depth for lined sections. . . . The cost of the Owyhee Project is estimated at approximately $1,446,000; including capitalization for operation, maintenance, and renewal of pumping plants, and for maintenance of siphons."

Flood relief for the Scioto Valley [Ohio], 1916, J. W. Alvord and C. B. Burdick (*Columbus, Ohio: State, 1916, pp. [XII]+279, pls. 36, figs. 32*).—This report includes the recommendations of the chief engineers for the adoption of the official plan of two detaining basins, "one each on the Scioto above Dublin and the Olentangy above Delaware and channel improvements for the 200,000 second-foot project, costing all told the sum of $10,125,000."

Preliminary report on Kearney Vineyard experimental drain, W. W. Weir (*California Sta. Bul. 273 (1916), pp. 103–123, figs. 11*).—This report, prepared in cooperation with the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture, deals with the drainage of an unproductive quarter section of alkali land, which was originally a vineyard.

The soil consists of sandy loam and fine sandy loam, and the alkali content varied in the surface foot from less than 0.2 per cent over most of the tract to 3 per cent over small areas. The principal salts were sodium chlorid and sodium carbonate, with the former predominating. "Observations taken during 1912 and the early part of 1913 showed that at no time during the year was the water table more than 7.5 ft. below the surface, and during June it stood within 2 ft. of the surface. During the entire growing season the water was less than 6 ft. from the surface and for four and one-half months was less than 4 ft. below the surface."

The drainage system installed consists of 21,842 ft. of drain, varying in size from 6 to 12 in. tile. The main drain has a fall of 1 in 1,000 and an average depth of about 7 ft. "The lateral system, consisting of eight parallel laterals on the east and nine on the west side of the main, is composed of 6-in. tile at an average depth of 5.75 ft. The laterals are 315 ft. apart." The total cost of the drain was $59.59 per acre.

"From measurements taken of the pump discharge it is evident that drainage systems under similar conditions should be designed to remove at least 1 cu. ft. per second for each 100 acres, especially where the drained tract is entirely surrounded by undrained land. Indications are that the lateral drains might have been placed 400 ft. apart. It would have been better had the lateral tile lines been placed 6.5 or 7 ft. deep instead of 5.75 ft. The hardpan, which was known to exist, has not proved to be a material hindrance to the movement of water.

"Two years' flooding has been sufficient to reduce the alkali present to an amount which is considered safe for crops. The tests show that although there was originally nearly two and one-half times as much NaCl as Na_2CO_3 in the surface foot of soil this salt is much more easily removed by flooding than the Na_2CO_3, and although the latter has been reduced by 15 per cent there was, at the end of the second year, more than one and one-half times as much Na_2CO_3 as NaCl in the surface foot of soil. . . . The tract has been changed, after three years, from that previously described to one producing a crop of 180 tons of grain hay in 1916."

Velocity coefficients for a dredged drainage canal, P. V. Hodges (*Engin. News, 76 (1916), No. 22, pp. 1052, 1053, figs. 6*).—Tests of the application of different formulas to the flow of water in a drainage canal 25 miles long, excavated by a ¾ cu. yd. dipper dredge in peat soil underlain with clay, are reported.

It was found by current meter measurements at two sections that the coefficient n of Kutter's formula varied from 0.0253 to 0.0259, and the velocity as computed with these values had a variation of 2.5 per cent within the range of this experiment. The coefficient m of Bazin's formula, $V=\frac{87}{0.552+\frac{m}{\sqrt{R}}}\sqrt{RS}$ varied from 1.127 to 1.164, and the velocity as computed with these values had a variation of 2 per cent. The coefficient C in the exponential formula $V=CR^{0.67}S^{0.54}$ varied 4 per cent. To obtain a formula that applies more closely to the law of flow in this canal, the formula $V=K(RS)^{0.68}$ was derived, in which K=229.6 The value of the coefficient K varied 1.8 per cent within the range of this experiment.

The value of n was found to decrease as the velocity or hydraulic radius increased, the condition of the channel remaining the same.

Reduction of seepage losses in a canal through porous shale, J. H. Miner (*Reclam. Rec.* [*U. S.*], *7 (1916), No. 12, pp. 568–570, fig. 1*).—Experiments conducted on canals of the Grand Valley Irrigation Project showed the favorable influence of artificial silting of canals in markedly reducing conveyance losses.

"The protective measures adopted consisted in excavating the canal through shale to a depth of 1 ft. below the required grade, with a view of allowing silt to accumulate in this extra depth. . . . Part of the earth lining was placed before water was turned into the canal and part afterwards. The work done with the water in the canal was the more effective in that the material compacted better and more quickly and also spread farther out on the canal bottom."

Care and attention necessary for maintenance of metal flumes, F. D. Pyle (*Reclam. Rec.* [*U. S.*], *7 (1916), No. 11, pp. 519, 520; rev. in Engin. Rec., 74 (1916), No. 21, p. 622*).—Experiments with seven paint and tar mixtures, including African black, Egyptian black, elastic graphite, green graphite, tar compound, coal tar, and green paint when used as preservatives for metal flumes on the Uncompahgre Project, are reported.

It was found "that the coal tar, coal-tar compound, and elastic graphite were the only mixtures that could stand one season's use, and there was some doubt as to the elastic graphite standing another season. It appears from observations on this project and the observations of project managers on other projects that coal tar is the best and cheapest mixture available. In some instances a first coat of water gas tar has been applied before the coal tar with excellent results. In tarring flumes care should be exercised to clean the surface thoroughly. All joints should be carefully tarred. It may be advisable to hot dip all sheets before they are placed in the flume."

Rectangular wooden flumes, J. C. STEVENS (*Engin. News, 76 (1916), No. 25, pp. 1160–1162, fig. 1*).—"The object of this article is to touch briefly on a few important points, connected with the design and construction of wooden flumes for irrigation and power purposes, that have not been treated either in textbooks or in technical articles."

Method of making drainage and improvement assessments, P. A. CUPPER (*Engin. News, 76 (1916), No. 21, pp. 975, 976*).—Suggestions for appraisal work in drainage and similar improvement districts are given.

The hygiene of water, A. GÄRTNER (*Die Hygiene des Wassers. Brunswick: Friedrich Vieweg & Son, 1915, pp. 952, pls. 11, figs. 93; abs. in Ztschr. Angew. Chem., 29 (1916), No. 17, Wirtschaftlicher Teil, pp. 141, 142*).—This is a handbook for engineers, waterworks superintendents, chemists, and medical officials. It deals with the sanitary aspects of domestic and other water supplies and with the chemistry and bacteriology of drinking water in general. Features of water-supply systems and apparatus are also dealt with.

Disinfection of drinking water by the successive action of sodium hypochlorite and hydrogen peroxid, E. DOYEN and TODA (*Compt. Rend. Soc. Biol. [Paris], 79 (1916), No. 6, pp. 232, 233; abs. in Chem. Abs., 10 (1916), No. 19, p. 2487*).—Experiments on the treatment of sterilized, distilled river and lake water to which 24-hour cultures of *Bacillus coli* and Eberth bacillus were added in a minimum amount of 20,000 per cubic centimeter are reported.

Labarraque solution containing 7.45 gm. of sodium hypochlorite (equivalent to 3.55 gm. of chlorin) per liter and officinal hydrogen peroxid containing 34 gm. hydrogen peroxid per liter were employed. When the Labarraque solution was used in an amount corresponding to 1 mg. of chlorin per liter of water, the water was sterilized in one minute. It is recommended, however, that an amount equivalent to 3 mg. of chlorin per liter of water be used, and that sufficient hydrogen peroxid be added at the end of five minutes to cause the evolution of all the oxygen of the sodium hypochlorite. Impure water treated successively with sodium hypochlorite and hydrogen peroxid was more palatable than that treated with sodium hypochlorite and sodium hyposulphate. The sterilizing action was also much more effective in the former than in the latter case. It is noted that the hydrogen peroxid used had no appreciable bactericidal action.

Laboratory manual of bituminous materials, P. HUBBARD (*New York: John Wiley & Sons, 1916, pp. XI+153, figs. 39; rev. in Engin. Rec., 74 (1916), No. 26, p. 778*).—This manual is primarily intended as a laboratory guide for students and others, its object being to describe methods in sufficient detail to enable the performance of the more common and widely used tests with a reasonable degree of accuracy. It is divided into three parts.

Part 1 gives general information on definitions of materials, tests, and uses; types and classification of bituminous materials, especially those for road and paving use; refining processes; and laboratory methods. Part 2, methods of testing, covers tests for density, consistency, and solubility of other than bituminous aggregates; heat tests; miscellaneous tests; and the extraction of bituminous aggregates and recovery of bitumen and aggregate. Part 3, characteristics of the more important bituminous materials, deals with fluid petroleum products and emulsions, semisolid and solid petroleum and asphalt products, refined tars and tar pitches, creosoting oils or wood preservatives, and bituminous aggregates.

Road material surveys in 1914, L. REINECKE (*Canada Dept. Mines, Geol. Survey Mem. 85 (1916), pp. VIII+244, pls. 7, figs. 16*).—This report is published in four parts.

Part 1 is a description of the various kinds of country roads, of the materials used in their construction, of the different varieties of stone outcropping at the surface of the earth, and of their comparative value as road-making materials.

Part 2 is a description of certain large deposits of diabase upon the north shore of Lake Huron. Part 3 is a report on road materials in Essex and Kent counties, Ontario, and Part 4 is a report on road materials along a portion of the north shore of Lake Ontario.

Reinforcement for concrete roads, J. R. CHAMBERLIN (*Cement Era, 14 (1916), No. 11, p. 44*).—A mathematical analysis of the stresses in concrete roads leads to the conclusion "that that type of reinforcement would be most efficient whose cross sectional area multiplied by the cube of the cosine of the angle between the reinforcing member and a line transverse to the roadway is a maximum."

Some factors in the Indiana road problem, G. E. MARTIN (*Purdue Univ. Dept. Engin., Highway Bul. 2 (1916), pp. 27, figs. 19*).—This is a summary and discussion of the various factors affecting the road problem in Indiana, including road mileage, topography, climate, soil, road materials, population, area, traffic, and finance.

Report of the [Iowa] State Highway Commission for the year ended December 1, 1915 (*Ann. Rpt. Iowa Highway Com., 2 (1915), pp. 221, figs. 55*).—This report deals with the organization, administration, road and bridge construction work, expenditures, and technical investigations during 1915.

Among other technical investigations one year of service tests on highway bridge paints brought out the following tentative results: "First, as a class the coal-tar paints are forming alligator cracks, but as yet are giving good protection, with a single exception. The coal-tar paint which has been exposed the longest time has more or less completely broken down, and there is evidence of rusting beneath the paint film. Second, the asphalt paints are cracking and checking on the approach of cold weather. There is yet no evidence of rusting of the iron underneath. Third, the red leads in general, especially where there is a large amount of inert material mixed in the pigment, are fading badly, and in some cases checking, chalking, and cracking. This fact would point to the recommendation that red lead paint be used in connection with a covering coat of a more stable paint. These paints are in general wearing better than the coal-tar or asphalt paints. Fourth, the sublimed white leads are as a rule wearing well. There is some evidence of checking. Fifth, the sublimed blue leads are in general wearing better than any of the other lead paints. Sixth, the best grades of iron-oxid paints are standing out exceptionally well, while the iron-oxid paints which contain calcium sulphate or calcium carbonate are showing signs of dissolution, leaving pit holes in the paint film. Seventh, where the graphite and carbon paints are placed next to the iron there are marked indications of corrosion or rusting. When used as a second coat over a prime coat of first quality iron oxid or lead these paints appear to be very serviceable. Eighth, the paints containing the highly inhibitive pigment, zinc chromate or lead chromate, are standing the service tests exceptionally well.

"The results thus far are such as to substantiate the requirements of the standard specifications for paint of the Highway Commission. In general, the paints which can be admitted under these specifications are wearing well, while those which would be excluded under these specifications are proving to be inferior in wearing quality and serviceability."

Third annual report of the State Highway Commission of the State of Maine (*Ann. Rpt. Highway Com. Maine, 3 (1915), pp. 195, fig. 1*).—This is a report of the work and expenditures on highway construction, maintenance, and repair in Maine from January 1 to December 31, 1915.

How to run the gas engine—simplified, L. ST. JOHN (*New York: Manhattan Electric Supply Co., 1915, 4. ed., pp. 55, figs. 3*).—This is a handbook for gas engine owners, tractioneers, and motorists.

Truck and tractor engines, H. L. Horning (*Gas Engine, 18 (1916), No. 12, pp. 590–600, figs. 3*).—This paper deals with "first, the demands made on modern truck and tractor engines; second, the most serious problems the engineer has met in fulfilling the demands; and third, the lines the development of the future is likely to take." Fuel and features of design receive special attention.

Exhibition trial of motor tillage implements (*Trans. Highland and Agr. Soc. Scot., 5. ser., 28 (1916), pp. 281–296, figs. 5; abs. in Jour. Bd. Agr.* [London], *23 (1916), No. 6, pp. 600, 601*).—This is a detailed report of trials previously noted (E. S. R., 34, p. 788).

[Special tests of tractors, 1915], M. Ringelmann (*Bul. Mens. Off. Renseig. Agr.* [Paris], *14 (1915), pp. 1176–1182*).—Tests of seven American tractors when traveling without load and when on mechanical cultivation, including draft tests, are reported. The more important results of the tests over soil without load are given in the following table:

Tests of tractors without load.

Calculated horsepower.	Condition of wheel rims.	Average speed per hour.	Fuel consumption per ton km.	State of soil.	Slip of driven wheels.
		Meters.	*Kilogram.*		*Per cent.*
7	Corners and projections	5,364	0.88		
9	Calks	5,148	.39	Slippery	3.0
19	Corners and projections	3,748	.28	Very slippery	6.3
17	Calks	5,364	.74	Dry	1.5
22	Fixed projections	2,232	.35	Slippery	3.0
22	Projections and pointed arches	3,276	.30	Very dry	.5
	Smooth	4;608	.24	Dry	1.5
26	Strips	3,060	.34	After rain	3.0
	Strips and pointed arches	3,060	.33	do	2.5
	Corners	3,240	.36	Sound	.5

The more important results of mechanical plowing tests are given in the following table:

Mechanical plowing tests.

Calculated horsepower.	Plowing depth.	Plowing width.	Distance plowed per hour.	Area plowed per hour.	Fuel consumption per hectare.	Average draft per square decimeter plowed.	Average horsepower utilized at drawbar.	Value of coefficient *m*.[1]
	Cm.	*Meters.*	*Meters.*	*Sq. meters.*	*Kg.*	*Kg.*	*Hp.*	*M.*
7	3.5	1.00	4,572	3,157	11.2	64.2	3.74	0.40
9	14.4	.56	4,032	1,351	44.2	42.9	5.16	.30
19	15.0	.64	2,952	1,340	40.4	43.0	4.51	.21
	16.0	.96	2,880	2,040	37.8	35.0	5.73	.28
	24.0	.59	2,916	1,217	47.9	43.0	6.57	.31
17	15.8	.57	2,952	1,048	99.4	43.0	4.23	.28
	18.1	.59	4,860	1,538	56.6	43.0	8.26	.33
22	13.2	1.50	1,728	1,935	22.8	52.6	6.66	.36
22	12.3	.99	3,132	2,205	36.8	45.1	6.38	.16
	16.1	.99	3,024	2,142	43.8	45.1	8.07	.21
	18.0	1.25	2,700	2,290	43.7	44.0	9.90	.29
26	14.2	1.19	2,880	2,290	30.1	55.5	9.99	.25
	15.4	1.17	2,844	2,214	30.4	55.5	10.52	.27
	16.5	1.20	3,060	2,439	28.9	61.2	13.73	.33

[1] In the equation $t=mP$, in which t=average draft and P=drive-wheel pressure on the soil.

Public tests of mechanical cultivating apparatus in 1916, P. Buchard (*Vie Agr. et Rurale, 6 (1916), No. 41, pp. 260–269, figs. 6*).—This report reviews the more important results of mechanical plowing tests made at five different

localities in France during 1916. The machines tested included tractors, motor plows, and motor cultivators.

Mechanical cultivation, R. Dessaisaix (*Jour. Agr. Prat., n. ser., 29 (1916), No. 20, pp. 341, 342*).—The more important results of plowing tests on hard, dry, calcareous clay soil at Tours, France, with six tractors are given in the following table:

Tractor plowing tests.

Horsepower.	Number of plow bottoms.	Average depth of plowing.	Surface plowed per hour.	Volume of soil plowed per hour.	Fuel consumption.	
					Per cubic meter of soil plowed.	Per hectare plowed 0.16 meter deep.
		Meters.	*Square meters.*	*Cubic meters.*	*Liters.*	*Liters.*
8-16	2	0.158	1,972.60	311.67	0.0275	44.00
8-16	2	.166	1,931.42	320.61	.0260	41.60
12-24	3	.146	1,864.51	272.21	.0276	41.76
12-20	3	.173	2,847.76	492.60	.0180	28.80
12-20	2	.193	2,629.41	507.47	.0140	22.40
8-16	2	.151	2,035.20	307.31	.0300	48.00

The more important results of plowing tests with four tractors on tenacious calcareous clay soil containing hills with grades of from 10 to 16 per cent are summarized as follows:

Tractor tests on hilly soil.

Horsepower.	Soil.	Number of plows.	Width of plowing.	Average depth of plowing.	Average speed per hour.	Area plowed in 10 hours.	Fuel consumption per hectare.
			Meters.	*Cm.*	*Meters.*	*Hectares.*	*Liters.*
15	Level and hilly	2	0.52	16.6	3,200	1.2	52.7
15	.....do	1	.38	19.0	3,000	.9	70.0
16	Level	2	.57	18.0	3,600	1.3	50.0
16	Level and hilly	2	.70	14.5	3,600	1.6	56.0
20	.....do	3	.98	20.0	2,800	2.0	40.0

Report on demonstrations with motor tractors at York, 1915, J. Gilchrist (*Univ. Leeds and Yorkshire Council Agr. Ed. [Pamphlet], 100 (1916), pp. 24, figs. 8; abs. in Jour. Bd. Agr. [London], 23 (1916), No. 6, p. 600*).—The general results of one-hour plowing tests on medium loam and uniform sandy loam soils with six internal-combustion tractors ranging in brake horsepower from 16 to 40, one 22-brake horsepower steam tractor, and a 10-horsepower motor plow are reported. The number of furrows plowed at one time varied from two to four.

Motor plows and motor plowing, A. Amos (*Jour. Roy. Agr. Soc. England, 76 (1915), pp. 74–91; abs. in Jour. Bd. Agr. [London], 23 (1916), No. 6, pp. 599, 600*).—The use of the motor plow to meet war time conditions in England is discussed, and general information is given regarding the organization, cost, and economy of motor plowing.

Engine plows, I. A. Weaver (*Trans. Amer. Soc. Agr. Engin., 9 (1915), No. 1, pp. 104–109, figs. 4*).—This is a discussion of the more important factors entering into the design of engine plows.

Experiments on mechanical cultivation at Grignon, F. Berthault (*Ann. École Nat. Agr. Grignon, 5 (1914), pp. 5–205, figs. 14*).—This is a detailed report of controlled experiments on mechanical cultivation at Grignon during 1913–14, giving results and conclusions.

N. G. E. A. data sheets compiled by H. R. Brate (*Lakemont, N. Y.: Nat. Gas Engine Assoc., 1916, pp. [310], figs. 10*).—Seven volumes of these data sheets are presented to date, as follows: Volume 1, National Gas Engine Association standards and general engineering data; volume 2, silage cutters; volume 3, feed grinders, grinders and crushers, buhr stone, and corn and cob crushers; volume 4, hay presses; volume 5, pumps; volume 6, electrical outfits; and volume 7, tractors.

Markets for agricultural implements and machinery in Argentina, F. H. Von Motz (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser., No. 125 (1916), pp. 86*).—This report gives detailed information regarding the market requirements of Argentina for all kinds of farm machinery, supplemented by data on agricultural conditions and trade methods.

Diagram for obtaining number feet B. M. in various timbers, W. R. Roof (*Engin. and Contract., 46 (1916), No. 21, p. 453, fig. 1*).—A diagram is given which affords a convenient method for obtaining the number of feet board measure for various sizes of timber.

The preservative treatment of farm timbers, E. A. Sterling (*Nat. Lumber Manfrs. Assoc., Trade Ext. Dept. Farm Bul. 3 (1916), pp. 17, figs. 6*).—This bulletin deals with preservatives, methods of treatment, preparing timber for treatment, kinds of timber suitable for treatment, conditions requiring treatment, and the cost.

New roofing materials for rural structures, R. De Saint-Maurice (*Vie Agr. et Rurale, 5 (1915), No. 1, pp. 9–13, figs. 9*).—This describes and illustrates and gives working data regarding five different types of composition roofing and zinc roofing, special reference being made to their use on farm buildings in France.

Grain storage buildings, K. J. T. Ekblaw (*Nat. Lumber Manfrs. Assoc., Trade Ext. Dept. Farm Bul. 2 (1916), pp. 16, figs. 3*).—This bulletin deals with the features of construction of grain-storage buildings, including the foundation, pressure on walls, floors, framing, walls, roof, and general arrangement, and describes and illustrates a small granary, a small corn crib, and a large grain-storage building.

Swine houses, K. J. T. Ekblaw (*Nat. Lumber Manfrs. Assoc., Trade Ext. Dept. Farm Bul. 4 (1916), pp. 22, figs. 6*).—This bulletin points out the essentials of a good swine house and describes and diagrammatically illustrates small portable houses and large permanent houses.

Dairy buildings at United States Naval Academy, C. D. Francis (*Hoard's Dairyman, 52 (1916), No. 21, pp. 725, 744, fig. 1*).—A brief description is given of the dairy buildings which are being constructed for the accommodation of about 200 cows on the dairy farm of the U. S. Naval Academy near Annapolis, Md.

Shedding for milch cows on Rhodesian farms, R. C. Simmons (*Rhodesia Agr. Jour., 13 (1916), No. 5, pp. 678–684, pl. 1*).—A permanent milch cow shelter of brick, thatch, and hardwood poles is described and diagramatically illustrated.

Implement sheds, K. J. T. Ekblaw (*Nat. Lumber Manfrs. Assoc., Trade Ext. Dept. Farm Bul. 1 (1916), pp. 19, figs. 6*).—This paper discusses the design of implement sheds and gives information with illustrations on the open shed, wide inclosed, and two-story types, and space requirements and selection of building material.

Farm residence heating, L. W. Eggleston (*Trans. Amer. Soc. Agr. Engin., 9 (1915), No. 1, pp. 41–49, figs. 10*).—The general features of steam and hot water heating of farmhouses are described and illustrated.

Electric lighting systems for farm use, C. H. Roth (*Trans. Amer. Soc. Agr. Engin., 9 (1915), No. 1, pp. 34–40*).—The author attempts to classify farm light-

ing systems, his purpose being apparently to advance a step in standardization. The systems are classified as follows: (1) Plants that give light only when the generator and engine are running; (2) plants that give light only from the battery, the generator being used only for charging the battery; (3) plants that give light from the battery or from the battery and generator combined; and (4) plants that give light either from the battery or generator, or from both.

The following general types coming under each class are suggested: Manual—plants that are entirely manually started, operated, regulated, and stopped; semiautomatic—plants that are partially automatic in some one or more features, but not entirely so; all automatic—plants that are entirely automatic in starting, regulating the voltage and charging battery, automatically stopping when the charge is complete or no lights are in use.

With reference to voltage, it is stated that "32 volts has become a standard for small plants having lights in a small area; 115 volts is better if the distribution system covers a considerable distance from the plant and if motors other than small household motors are to be used." With reference to speed of generator, it is stated that "if belt driven, 2,300 revolutions per minute or less gives general satisfaction. If direct connected to the engine the speed should be lower, perhaps 800 to 1,000 maximum, although experiments are continually being made to produce higher speed engines that are not noisy and have a reasonable life."

Sewage disposal for country homes, F. F. FRAZIER (*Kans. Agr. Col. Ext. Bul. 6 (1916), pp. 30, figs. 6*).—This bulletin describes and illustrates the design and construction of small sewage disposal systems consisting of septic tanks and tile absorption areas. The author lays more stress on the chemical and bacteriological phases of sewage purification than has been the custom in previous reports by others on the subject, and his recommendations indicate that some study along that line has been made.

RURAL ECONOMICS.

[A study in social dynamics], J. M. GILLETTE (*Quart. Pubs. Amer. Statis. Assoc., n. ser., 15 (1916), No. 116, pp. 345–380, figs. 2*).—The author has endeavored to determine statistically the rate of natural increase and the factors accounting for the increase in the rural and urban population of the United States. He describes in detail the method used and the results obtained. The natural increases as determined by his method are shown in the following table:

Rates of birth, death, and natural increase in the United States for the decade 1900–1910.

Division.	Birth rate.		Death rate.		Rate of natural increase.	
	Rural.	Urban.	Rural.	Urban.	Rural.	Urban.
New England	21.0	24.4	16.0	17.1	5.0	7.3
Middle Atlantic	25.5	26.4	14.8	16.8	10.7	9.6
East North Central	25.2	24.7	12.8	13.9	12.4	10.8
West North Central	28.4	22.5	10.3	12.4	18.1	10.1
South Atlantic	34.4	25.4	15.5	19.4	18.9	6.0
East South Central	34.4	25.4	14.7	18.0	19.7	7.4
West South Central	36.4	27.0	12.5	16.8	23.9	10.2
Mountain	31.6	25.5	10.5	15.0	21.1	10.5
Pacific	24.6	20.4	12.0	13.8	12.6	6.6
United States	30.4	25.2	13.5	16.4	16.9	8.8

His analysis reveals the fact that the increase of 11,826,000 for the urban districts consisted of 924,000 persons added by incorporation, 4,849,000 by immigration, 3,637,000 by rural migration, and 2,426,000 by natural increase. The increase of 4,151,000 in the rural districts was due to additions by migration of 1,290,000 and a natural increase of 2,861,000.

Some economic factors which influence rural education in Wisconsin, E. Merritt and K. L. Hatch (*Wisconsin Sta. Research Bul. 40 (1916), pp. 51, figs. 20*).—In this study, conducted in cooperation with the U. S. Department of Agriculture, it was found that the number of farms in the northern portion of the State were increasing while in the southern portion there was a decrease in the number, the decrease being due to the elimination of farms containing between 20 and 99 acres. The size of the farm family was decreasing, due to the fact that the rural population contained a smaller percentage of those of foreign birth than formerly.

In the extreme northern and southern parts of the State there were a large number of schools which had an enrollment of 15 pupils or less. Apparently these small schools in the southern part of the State were results of not only a decrease in the number of farms but also in the size of the farm family. In the northern portion of the State the small school was due to the sparse settlement of the rural districts.

An effort was made to ascertain the relationship between tenantry and rural education. It was found that there were two classes of tenants in Wisconsin, those who are related to the owners of the farms and those who are not. The former, as a rule, are a more or less permanent class in a community and therefore have a vital interest in the system of education which is being developed. It was found also that the percentage of the total farmers who were tenants and married a specified number of years decreased as the number of years married increased. In other words, there is a ladder by which the tenant farmer passes from the tenant class into that of the farm owner. Since the tenant, as a rule, has been married a smaller number of years than the owner, he naturally has a smaller number of children and a large proportion of them are not of school age.

In the study of the school attendance it was found that the city children were attending school in relatively greater numbers than rural children between the ages of 6 and 14, while the reverse was true for those between 15 and 20 years of age. The economic conditions under which the country boy and girl live apparently enable them to attend school in larger numbers in the more advanced years, whereas the smaller children in rural districts are unable to attend on account of the distance that many of them live from the schools and the poor condition of many of the country roads.

The system of education carried on by the public schools and the extension department of the agricultural college was found to provide no training for the boy after he left school until he takes up farming on his own account. This period is generally between the ages of 18 and 25. The returns also indicated that the girls were leaving farms faster than the boys, and that the children were leaving the smaller farms faster than those living on the larger ones.

Data as to the value of a high-school education indicated that it was a good investment for the farmer. It also paid the boy who intended ultimately to be a farmer to stick by the farm rather than to engage in another occupation.

Additional information was obtained to ascertain what were the sources of incentive to adopt the more progressive agricultural practices, labor incomes of farmers with different types of education, costs of instruction in different types of agricultural schools, etc.

Twelve ways to meet the new economic conditions here in the South, G. W. CARVER (*Alabama Tuskegee Sta. Bul. 33 (1917), pp. 3–7*).—The author has pointed out how the southern farmer can best succeed under boll-weevil conditions. He advises the growing of food for the family and live stock on the farm, the growing of an early maturing type of cotton, and thorough culture and manuring of the land.

The use of a diary for farm accounts, E. H. THOMSON (*U. S. Dept. Agr., Farmers' Bul. 782 (1917), pp. 18, figs. 5*).—The author believes that the diary may serve two purposes: (1) To keep those records which are of a financial nature, such as receipts and expenditures; and (2) to keep those records of farm work and production, such as dates of planting and harvesting, crop yields, feed fed to live stock, etc. The bulletin describes several different kinds of diaries and shows how various farm accounts may be kept in diary form.

Report of the commission on land colonization and rural credits of the State of California, E. MEAD ET AL. (*Rpt. Com. Land Colon. and Rural Credits Cal., 1916, pp. 87*).—In this report are discussed the history of land settlement, methods of financing settlers in California, and methods used in land settlement in European and other countries.

Report on the working of the cooperative societies in Bengal, 1914–15, J. M. MITRA (*Rpt. Work. Coop. Socs. Bengal, 1914–15, pp. 29+II+XXX+3*).—The author points out the progress which has been made in the work of these societies, and describes the activities of the central banks, the agricultural and nonagricultural societies, and other forms of cooperative agricultural effort, such as grain banks, cooperative dairies, sugar factories, weavers' societies, and supply societies. Statistical data are given showing the membership of the associations and the amount of business done.

Insurance against loss from hail, H. LAGRANGE (*Bul. Dir. Gén. Agr. Com. et Colon, Tunis, 20 (1916), No. 88, pp. 111–144*).—The author discusses briefly the methods of developing hail insurance and the experience with it in France, Algeria, Tunis, Switzerland, Germany, Austria, Bulgaria, Canada, and Italy.

A summary of the market situation in Boston (*City Planning Bd., Boston, Doc. 118 (1915), pp. 175, figs. 19*).—This report sets forth the sources of Boston's supply of perishable food, the organization of the wholesale and retail trade, internal transportation, problems of general transportation, and an outline of a plan for improving the methods of distributing the food supply within the city. There is also included information regarding the receipts of foodstuffs and prices and an extended bibliography on public markets.

[Marketing of live stock], L. D. HALL (*Iowa Yearbook Agr. 16 (1915), pp. 442–445*).—The author describes the activities of the Office of Markets and Rural Organization of the U. S. Department of Agriculture in studying the marketing of live stock.

Principles of the grain trade of western Canada, C. B. PIPER (*Winnipeg, Canada: Author, 1915, pp. VII+179*).—The author has discussed the method of marketing grain in western Canada under the topics of transportation, inspection, country elevators, terminal elevators, grain exchange and the marketing of grain, financing the crop movement, the Canada Grain Act and Board of Grain Commissioners, and the economic relation of the grain trade to the farm.

Wholesale prices, Canada, 1914, R. H. COATS (*Canada Dept. Labor, Wholesale Prices, Canada, 1914, pp. XVII+259, figs. 15*).—This report continues the information previously noted (E. S. R., 32, p. 490), adding data for 1914.

Wholesale prices, Canada, 1915, C. W. BOLTON (*Canada Dept. Labor, Wholesale Prices, Canada, 1915, pp. XVI+312, figs. 27*).—This report continues the information noted above, adding data for 1915.

[Agricultural statistics of the United States] (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Statis. Abs. U. S., 38 (1915), pp. 113–154, 506–511, 518–528*).—There are brought together in this statistical abstract data regarding the number of farms, extent of improved and unimproved land, value of agricultural land and buildings, area, production and value of crops, number and value of live stock, total and per capita consumption of important agricultural products, and prices of agricultural products. The data given are for 1915 with comparative figures for earlier years.

English agriculture, B. Skalweit (*Ber. Landw. Reichsamte Innern, No. 37 (1915), pp. VII+535, pls. 3*).—In this volume are discussed the climate, topography, agricultural institutions, soil, types of farming, changes in the method of live stock and crop production, home supply of food, and the imports of agricultural products.

A short history of English rural life, M. Fordham (*London: George Allen & Unwin, Ltd., 1916, pp. XVI+183, pl. 1*).—The author gives a brief history of English agriculture and references to acts of Parliament and royal ordinances relating to agriculture and agricultural laborers and landlords.

Report of the departmental committee on food production in Ireland (*Dept. Agr. and Tech. Instr. Ireland, Rpt. Dept. Com. on Food Production, 1 (1915), pp. VI+22; 2 (1916), pp. VI+94*).—This report discusses the status of agriculture in Ireland relative to land in crops, number of live stock, prices of agricultural products, and facilities for obtaining agricultural implements and machinery. The second volume contains the minutes of the hearings held in connection with the gathering of evidence for the report.

[Agricultural statistics of Russia] (*Rec. Données Statis. et Écon. Indus. Agr. Russie et Pays Étrangers, 9 (1916), pp. XIV+649*).—This report continues data previously noted (E. S. R., 33, p. 193), adding data for 1914–15.

Agricultural statistics of Java and Madura (*Jaarc. Konink. Nederlanden. Koloniën, 1913, pp. 64–76*).—This report continues data already noted (E. S. R., 32, p. 894), adding data for 1913.

[Agriculture in Japan] (*Statis. Rpt. Dept. Agr. and Com. Japan, 31 [1914], pp. 1–121*).—These pages continue the data previously noted (E. S. R., 33, p. 395), adding information for 1914.

AGRICULTURAL EDUCATION.

History of the Maine State College and the University of Maine, M. C. Fernald (*Orono, Me.: Univ. Maine, 1916, pp. 450, pls. 40*).—The author presents in the first eight chapters the important facts and incidents, in chronological order, of the different administrations of the University of Maine. These are followed by chapters, written by different members of the university faculty, relating to special departments and interests of the institution, including, among others, the development and progress of the college of agriculture and the organization and development of the experiment station.

[Proceedings of the agricultural and domestic science sections of the high school conferences for 1912, 1913, 1914], edited by H. A. Hollister (*Univ. Ill. Bul., 10 (1913), No. 19, pp. 50–65, 106–115; 11 (1913), No. 17, pp. 63–85, 130–143; 12 (1915), No. 21, pp. 95–114, 163–172*).—The reports of the proceedings of the agricultural section of the Illinois high school conferences include for 1912 an outline of a one-semester course for high schools in forest, orchard, and garden work, by A. W. Nolan; and abstracts of papers on School and Home Gardens, by C. Colvin; Cereal and Forage Crops, by A. J. Beatty, indicating the extent of instruction in agriculture in Illinois high schools; and on how

much attention is being given to dairy instruction in Illinois high schools, by C. H. Keltner. For 1913, abstracts are given of papers on the Introduction of Agriculture in High Schools, by W. L. Eikenberry; A Course in Animal Husbandry, by R. R. Snapp; Country Life Clubs, by G. W. Brown; and A Course in Soils for Secondary Schools, by J. W. Morgan. For 1914, papers are given on Extension Work for the High School, by L. F. Fulwiler, describing the extension work of the Mt. Pulaski Township High School; Collection and Organization of Suggestions for Teaching High School Agriculture, by I. A. Madden; and the Differentiation of Fundamentals and Accessories in the Content of High School Agriculture, by R. Muckelroy.

The proceedings of the home economics section include for 1912 a report of the executive committee on the revision of the syllabus for the grades and high school, including a summary of the time and place given to domestic science in high school curricula, and a discussion of The Teaching of Millinery in the High School, by Edith Welty. For 1913, suggestions are given by Miss Helena M. Pincomb as the result of a study in values or the evolution of domestic science, and abstracts of papers on The Principles of Natural Science Fundamental to the Teaching of Domestic Science in the High School, by Miss Mary Moore; The Method of Teaching Principles and Experiments, by Miss Thomas; and Art Principles and Suggestions for Their Application, by Miss Mary B. Hill. For 1914, a report is given from the executive committee, including outlines adopted by the section, as to the first four lessons in sewing for the fifth grade and the first four lessons in cooking and housekeeping for the seventh grade, and a paper on The Correlation of Drawing and Design with Domestic Arts in the Home Arts Course at New Trier Township High School, by Miss Olive L. Grover.

Education as it affects agriculture, C. Turnor (*Jour. Cent. and Assoc. Chambers Agr. and Agr. Rec.* [*London*], *n. ser., 5* (*1916*), *No. 42, pp. 93–97*).—This is a report on the question of education in its relation to agriculture with special reference to the problem of how to increase the annual output of skilled cultivators of and workers on the land, presented by the education committee of the Central and Associated Chambers of Agriculture of Great Britain at a meeting held July 11, 1916.

Attention is called to the fact that 50 years ago the number of men working on the land in the United Kingdom was greater by 1,000,000 than it is to-day, and to the concurrent steady decline in the production of the land. The present status of elementary, intermediate, and advanced agricultural education, and the training of teachers, is briefly reviewed. The committee recommends that the instruction of the elementary schools be made more practical and more truly based upon surrounding life; that new schools be established similar to the centralized continuation day schools existing in Canada, as well as a system of lower grade instruction centers with courses that would review, complement, and give a more directly vocational bearing to the practical work already done in the schools for boys and girls, a new type of farm school for boys and girls between 13 and 18 years of age, to continue the instruction from the elementary school and definitely prepare them for settling on the land either in the United Kingdom or in the British Dominions, and farm lads' clubs; that definite measures should be taken to interest the children in town schools in country life and to induce more poor-law children to become interested in the cultivation of the land; that as far as possible all reformatories and industrial schools should have farms attached and the pupils more directly encouraged to study agriculture; that continuation instruction should be made compulsory; and that training should be developed to enable country children to enter the teaching profession.

Fifteenth annual general report of the Department of Agriculture and Technical Instruction for Ireland (*Dept. Agr. and Tech. Instr. Ireland, Ann. Gen. Rpt., 15 (1914–15), pp. V+219*).—This is a report on the department's administration and funds and the details of its work during 1914–15, including agricultural and technical instruction.

Exercises in agriculture, S. H. DADISMAN (*Chicago: Lyons and Carnahan, 1916, pp. 160, figs. 34*).—This laboratory manual and notebook contains 100 exercises which have been tried in high schools by the author and are recommended for laboratory work, two periods each week if possible, in a one-year course in agriculture. They comprise studies of plants, animals including poultry, soil and plant growth, farm mechanics, pomology, potatoes, the hotbed, the garden plat and record, forestry, weeds, birds, collecting and mounting insects, and farm management. A minimum list of apparatus and material for high-school agriculture is included.

One hundred exercises in agriculture, J. H. GEHRS and J. A. JAMES (*New York: The Macmillan Co., 1916, pp. XI+222, figs. 60*).—The exercises outlined in this laboratory manual and notebook deal with soils, field crops, farm animals including poultry, plant propagation, horticulture, and farm management. They are the outgrowth of the author's work in teaching agriculture in the high schools of Missouri and Wisconsin. Lists of helpful government publications and of equipment and supplies are included.

Courses of study in agriculture and minimum of required equipment for the farm-life schools of North Carolina, E. A. HODSON (*Raleigh, N. C.: Dept. Pub. Instr., 1915, pp. 60, figs. 22*).—This bulletin contains an outline of the four-year course in agriculture and related subjects and the minimum of general equipment, with estimated cost, for approved farm-life schools in North Carolina; also suggested additional equipment needed for work in the special departments, suggested text and reference books, and lists of books and bulletins for the library. The agricultural work has been outlined to meet the needs of the boy or girl who does not intend to go beyond the high school. Students who are preparing for college may take the regular high-school course and as much of the agricultural work as possible. The agricultural instruction includes botany and the elements of agriculture in the first year, field crops, vegetable gardening, and fruit culture in the second year, farm animals, feeding live stock, dairying, and poultry raising in the third year, and soils and fertilizers and rural economics in the fourth year. Practical work is outlined for each subject.

[Rural school agriculture] (*Cornell Rural School Leaflet, 10 (1916), No. 1, pp. 426, pls. 2, figs. 238*).—This leaflet is devoted to (1) studies of birds, animals, insects, plants, and trees for 1916–17, as outlined in the New York State Syllabus, including among others the following articles: The Pig, by E. S. Savage; Hog Cholera, by R. R. Birch; The Honey Bee, by Anna B. Comstock; Legumes, by G. F. Warren; The Bean, by Anna B. Comstock; Field Beans, by E. V. Hardenburg; A Serious Bean Disease, by M. F. Barrus; The Collection and Preservation of Specimens of Plants, by K. M. Wiegand; The Soil, by E. O. Fippin; and Ten Lessons on the Apple, by E. L. Overholser; (2) home making, including Directions for Canning and Jelly Making, by Helen Knowlton; and an article on Yeast and Bread Making, by Flora Rose; and (3) suggestions to teachers, and articles on Corn Day; General Exhibitions for Farmers' Week, February, 1917; Exhibitions, Fairs, and Competitions; and The Nature and Procedure of Junior Home Project Work, by F. L. Griffin. A list of reference books pertaining to the subjects treated in the leaflet is appended.

The story of the forest, J. G. DORRANCE (*New York: American Book Co., 1916, pp. 237, figs. 113*).—This book, which has been prepared chiefly for use

in the schools, discusses the forests of America, the tree and how it lives and dies, how to know the trees, work in the woods, by-products of the forest, and trees in American history.

The principles of feeding farm animals, S. BULL (*New York: The Macmillan Co., 1916, pp. XIX+397, figs. 87*).—This volume aims to present the scientific facts underlying the art of feeding animals. Somewhat definite rules are given regarding the feeding of different classes of live stock and the formulation of rations. Instead of devoting separate chapters to the feeding of the different classes of farm animals, the use of each of the principal feeds for the different species and classes of live stock is discussed. Particular attention is given to the fertilizing values of feeds and rations. The book is intended for use as a college text in general feeding as well as by the farmer who has not had a technical education in agriculture.

Judging horses as a subject of instruction in secondary schools, H. P. BARROWS (*U. S. Dept. Agr. Bul. 487 (1917), pp. 31, figs. 16*).—Specific directions are given for teaching the judging of horses, classroom discussion, practice judging, estimating the age of a horse and matters of unsoundness, comparative judging, and demonstrations.

Poultry production, W. A. LIPPINCOTT (*Philadelphia: Lea & Febiger, 1916, 2. ed., rev. and enl., pp. X+17–517, pl. 1, figs. 239*).—This is the second revised and enlarged edition of this text, previously noted (E. S. R., 32, p. 570), including the addition of a chapter on Poultry Diseases and Parasites.

Lessons on poultry for rural schools, F. E. HEALD (*U. S. Dept. Agr. Bul. 464 (1916), pp. 34, figs. 13*).—Thirteen lessons on poultry raising, arranged in seasonal sequence, are outlined, including class study and correlations, reinforced by practical exercises in or near the school, and the home project. These lessons are preceded by general directions for organizing home or club project work and supplemented by specimen forms for district poultry surveys and a census, a pupil's monthly summary of the laying flock, monthly account, balance sheet, cropping plans, and poultry club report, a list of publications related to the subject, etc.

Mechanical drawing for the farm and agricultural school, G. F. KROGH (*Bul. Univ. Minn., Gen. Ser., No. 43 (1916), pp. 72, pls. 8, figs. 84*).—This bulletin covers the general principles of drawing, gives a few simple exercises of geometrical construction, graphic methods to show crop yields, etc., maps and topographical drawings, and various methods of representing engineering and architectural data in the form of drawings, and supplies the standardized symbols used in the various lines of drawing for different representations. It has been prepared for use in agricultural schools and for the farm.

Agricultural arithmetic, W. T. STRATTON and B. L. REMICK (*New York: The Macmillan Co., 1916, pp. X+239, figs. 50*).—This text is adapted to the requirements of advanced classes in rural elementary schools, agricultural high schools, and other high schools giving instruction in agriculture. Its purpose is to present the basic principles of arithmetic by making use of problems met in daily experience in rural communities, including farm accounts, graphs and their application, percentage, practical measurements, gain and loss, commission, taxes, insurance, interest, business papers, powers and roots, and ratio and proportion.

Rural arithmetic, A. O. THOMAS (*New York: American Book Co., 1916, pp. 288, figs. 93*).—In this book, which may be used as an auxiliary text in either grammar or high schools, the principles of arithmetic are applied to the material with which the farmer comes in daily contact. The problems deal with the parcel post; land measurements; labor, machinery, and crops; feeding; farm animals; farm records and accounts; soils and rainfall; light, fuel, and

water; building; taxation, bank account, insurance, and the market; household economics, etc. Tests for accuracy and speed, 100 proficiency questions, reference tables, and the answers to the problems are included.

Household arts and school lunches, ALICE C. BOUGHTON (*New York: Russell Sage Foundation, 1916, pp. 170, pls. 11*).—This report is one of the 25 sections of the report of the Education Survey of Cleveland conducted by the Survey Committee of the Cleveland Foundation in 1915. It deals with (1) household arts in elementary schools, its growth in the United States, and its growth and present status in Cleveland; (2) the relation of household arts to elementary education; (3) infant hygiene; (4) household arts in Cleveland high schools; (5) the relation of household arts to secondary education; (6) elementary school lunch service; and (7) high school lunch service.

MISCELLANEOUS.

A brief statutory history of the United States Department of Agriculture, F. G. CAFFEY (*U. S. Dept. Agr., Off. Solicitor* [*Pub.*], *1916, pp. 26*).—A reprint of the article previously noted (E. S. R., 34, p. 796).

Federal legislation, regulations, and rulings affecting agricultural colleges and experiment stations (*U. S. Dept. Agr., States Relations Serv.* [*Pub.*], *1916, pp. 44*).—A revision to August 15, 1916, of the circular previously noted (E. S. R., 35, p. 94).

Twenty-ninth Annual Report of Vermont Station, 1916 (*Vermont Sta. Bul. 199* (*1916*), *pp. 16*).—This contains the organization list, a brief announcement concerning the station, a financial statement for the fiscal year ended June 30, 1916, and a report of the director on the publications and work of the station.

Twenty-ninth Annual Report of Vermont Station, 1916 (*Vermont Sta. Rpt. 1916, pp. XX+726, pls. 68, figs. 105*).—In addition to the material noted above as Bulletin 199, this contains reprints of Bulletins 191–193, previously noted, and of Bulletins 194–198, abstracted elsewhere in this issue.

Concerning certain technical bulletins and concerning the annual report (*Vermont Sta. Circ. 11* (*1916*), *pp. 4, figs. 8*).—A brief statement regarding the distribution of Bulletins 194–201 and the annual report of the station.

Index to Popular Bulletins 1 to 100 (*Washington Sta., Index Pop. Buls. 1–100* (*1916*), *pp. 30*).—This is a combined subject and author index.

NOTES.

Georgia College.—G. R. Skinner and W. H. Allen have succeeded C. J. Goodell and D. J. Taylor as assistant in animal husbandry and supervisor of poultry clubs, respectively. C. A. Whittle has resigned as editor-librarian, J. M. Purdom, jr., being appointed editor and Miss Nelle M. Reese, librarian. M. C. Gay has been appointed field agent in marketing.

Missouri University and Station.—C. E. Mangels, assistant chemist at the Ohio Station, has been appointed instructor in agricultural chemistry and assistant in the station beginning April 1. Mitchell D. Wood has succeeded C. W. Sheppard, who is to take up farming, as assistant in animal husbandry.

New Jersey College and Stations.—The short courses in agriculture, which closed February 21, were completed by 98 students, 39 being in general agriculture and dairy farming, 27 in fruit growing and market gardening, 22 in poultry husbandry, and 10 in home economics.

J. W. Day has resigned as assistant in agronomy in the college and Ralph M. Hubbard as field assistant in horticulture in the state station. Miss Carrie E. Pimm has been appointed assistant extension specialist in home economics.

Porto Rico Federal Station.—Harvey E. Thomas, assistant plant pathologist of the Virginia Station, has been appointed scientific assistant in plant pathology.

South Carolina Station.—The division of entomology is completing plans for a field laboratory in one of the coastal counties, for the study of nematodes and American mole crickets. Experiments have been continued in regard to the making of home boiled concentrated lime-sulphur wash, and a formula has been worked out which gives a very satisfactory wash of the same specific gravity as the commercial preparations.

Twelve additional poultry houses have been constructed to house selected breeding pens of Barred Plymouth Rocks, Single Comb Rhode Island Reds, Orpingtons, and Single Comb Black Minorcas, and the various experimental and breeding pens of heavy-laying Single Comb White Leghorns. Experiments are under way to determine the relative value of anthracite coal and kerosene as fuels for heating brooder stoves in the South. A special brooder house has been built for this experiment.

Texas College and Station.—The state legislature has established a West Texas Agricultural and Mechanical College of a grade coordinate with the existing institution, as well as a junior college located elsewhere to give two years of high school agriculture and two years corresponding to the freshman and sophomore years of college work. The location of the West Texas college is to be determined by a board consisting of the governor, lieutenant governor, state commissioner of agriculture, state superintendent of public instruction, and two members of the legislature.

V. L. Cory, superintendent of the Denton substation, resigned December 31, 1916, and was succeeded on January 25 by C. H. McDowell, a 1912 graduate of the college, previously engaged in farming and extension work in the State. H. Lebeson, assistant chemist, resigned February 20 and was succeeded by Charles Buchwald, and he in turn by G. B. L. Smith.

Vermont University and Station.—Gardner Smith Fassett, trustee of the institution from 1890 to 1914, died January 19 at the age of 85 years. During his entire period of service he was a member of the station board of control and actively associated with the management of the college farm and the construction of many of the buildings.

Dominion Experimental Farms.—The new experimental farm at Morden in South Manitoba is to be devoted to experimental work in horticulture on a larger scale than hitherto at any of the prairie stations. Cultural and variety trials and the selection, testing, and breeding of horticultural plants will be carried on. A tract of about 285 acres of land has been secured. Eight acres were planted in the spring of 1916 to apples, plums, cherry hybrids, and small fruits, and considerable nursery seeding was done. Good growth was attained during the summer, although considerable winterkilling is expected. The commercial possibilities of small-fruit growing will also be tested.

Philippine College of Agriculture.—Otto A. Reinking, of the Colorado College and Station, has been appointed instructor in plant pathology, and B. M. Gonzalez instructor in animal husbandry. Dr. Manuel Roxas has succeeded Guy Clinton, resigned, as instructor in chemistry.

Contributions from the U. S. Department of Agriculture and the Experiment Stations to American Chemical Journals.—Under the heading of A Census of the Periodical Literature of Chemistry Published in the United States, Marion E. Sparks and W. A. Noyes present in the issue of *Science* for February 16 a compilation as to the number and pages of the original papers in chemistry published in five of the principal chemical journals of this country during 1909–10 and 1914–15. In the former period the total number of papers was 796, aggregating 9,225 pages, and for the latter period, 1,415 papers and 13,624 pages.

It is of interest to note that the publications of the government bureaus, experiment stations, etc., which are grouped together, numbered in 1909–10, 93, aggregating 827 pages, and in 1914–15, 253, aggregating 2,247 pages. The research papers of the general scientific institutions numbered 43, aggregating 443 pages, in 1909–10, and 133, aggregating 1,277 pages, in 1914–15.

Miscellaneous.—A committee of representative agricultural leaders has been appointed by the president of the Board of Agriculture and Fisheries of Great Britain, to advise him on questions pertaining to the increased production of food. Hon. R. E. Prothero is chairman of this committee and among others may be noted Sir Sydney Oliver, F. L. C. Floud and T. H. Middleton of the board, A. D. Hall and W. W. Berry of the Development Commission, and Prof. W. Somerville.

The membership of the committee on agriculture of the U. S. National Research Council is announced as follows: Raymond Pearl, chairman, E. W. Allen, C. L. Alsberg, H. P. Armsby, Eugene Davenport, E. M. East, L. O. Howard, L. R. Jones, W. H. Jordan, K. F. Kellerman, J. G. Lipman, Theobald Smith, W. J. Spillman, and W. M. Wheeler.

According to a recent note in *Nature*, an institute for research in genetics was opened in April, 1916, at Potsdam in connection with the Agricultural High School of Berlin. Prof. Erwin Baur is serving as director of the institute.

Dr. Johanna Westerdijk has been appointed associate professor of phytopathology in the University of Utrecht. She is said to be the first woman to receive an appointment of this nature in Holland.

Horace Cardinell, a 1914 graduate of the Oregon College, has been appointed horticulturist for the Brazilian Government, for work in the comparatively undeveloped southern section of the country.

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The Agricultural Experiment Stations of the United States.

U. S. DEPARTMENT OF AGRICULTURE
STATES RELATIONS SERVICE
A. C. TRUE, DIRECTOR

Vol. 36 MAY, 1917 No. 7

EXPERIMENT STATION RECORD

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

U. S. DEPARTMENT OF AGRICULTURE.

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[1] Director. [2] Agronomist in charge. [3] Animal husbandman in charge. [4] Acting director.

EXPERIMENT STATION RECORD.

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[1] Printed in scientific and technical publications outside the Department.

EXPERIMENT STATION RECORD.

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At this time, when the air is surcharged with plans for preparation for war, agriculture occupies an unwonted prominence. The importance of making adequate provision to encourage and assure a high scale of production of the necessities of life ranks in the mind of the public alongside of preparation for the actual military operations. Its realization is more keen and intelligent than ever before, growing out of both the experience of Europe and the special part this country is expected to play at the present time.

Very naturally every agency, and especially every institution, has given consideration to the manner in which it can best contribute to the common end at this time. The agricultural institutions have been quick to realize their place and responsibilities and to see the strategic opportunities of the industry they represent. In many of the States they have furnished the initiative and taken the leadership in measures for insuring adequate supplies through agriculture. They have shown how many-sided the problems in this field often are. These problems touch the whole life and organization of the people—economic, social, and even personal. They develop in a remarkably striking way the interrelations of farming and other lines of business—of providing the supplies for the farmer, as well as those resulting from his labor, when and where they are needed, and hence of uniting and correlating the whole fabric of production, trade, and distribution.

The manner in which the agricultural institutions of the country, especially the agricultural colleges, have thrown themselves into this effort, with promptness, resourcefulness, and broad intelligent understanding, shows the element of strength which they supply and the powerful national resource they are. It makes possible, under efficient organization and cooperation, a mobilization of agricultural resources the like of which has not been seen in this country; and it brings out in strong light the advantage of the policy the Government has pursued in promoting agricultural education and research on a national scale and an intimate type of instruction reaching out to the individual farmer on his land.

The spirit of service so dominant throughout the country has found a quick response in the agricultural experiment stations.

The main question is as to just the part they should play. Some workers are feeling that the opportunity there is less than in certain other avenues—that the occasion calls for putting present knowledge into effective use rather than for further accumulation. According to this view, the chief burden will rest most heavily on the extension service and the other agencies for promoting intimately the business of producing food and clothing. But even if this be true, the experiment stations have their part to perform, and it is by no means a small or insignificant one.

The experiment station is a practical institution in its final reach and purpose; it pursues science for the benefit of agriculture, which is a practical art. It is a source of new information, of advanced knowledge, of expert advice and suggestion; it should be the chief original source of such information in its locality. This makes it resourceful in suggestion and extremely helpful in a time when special emphasis is laid on the endeavor to make every effort count in greater food production and the avoidance of loss and waste. Its corps of experts should be found useful in organizing and planning the agricultural campaign, as well as making it efficient through indirect efforts.

As organizations, the experiment stations should in effect place themselves at the disposal of the country to do the special work which they are organized for, adapting themselves in considerable measure to the present need. This can be done without seriously interfering with established lines of investigation which would suffer if neglected, or very radically changing the general program of activity. Every station has a considerable amount of miscellaneous work and routine activity, flexible in quantity and variable in character. Every station also performs a considerable amount of experimental work and testing designed to give results of quite immediate practical application, and especially adapted to changed economic or local conditions. At a time like this such efforts may be regulated and directed, and if need be enlarged, so as to aid in an important way in increasing the outcome of agriculture, avoiding loss, and utilizing unusual resources, as has the work of the stations in European countries.

Manifestly the first requirement is to recognize the position and the opportunity of the stations at this time, and to a considerable extent this has already been done. They need also to adapt their attitude toward the work in hand, so that they will think and observe outside of the special field they have blocked out and have been following in the past, and will not shrink from interruption if need be. In other words, if they are to realize the full measure of their opportunity they can not remain too exclusively absorbed in their routine investigations or the formulated plan for experiment. As leaders of agricultural thought, they need to be ready to see the field and take the

initiative in doing their special part. This will require that they be watchful, alert, and ready.

The effort in the direction of agricultural preparedness has taken the form of increased production of staple crops, live stock, and other food products by farmers, and utilizing land and labor not employed in agricultural production in ordinary times. While this involves especially the services of the county agent and other agencies for direct stimulation and instruction, it also involves supplying these agencies with reliable information and advice which will make the effort productive. Every experiment station will naturally take an especially active practical interest in the movement for more extensive and greater efficiency in production. It will maintain a close contact with these movements through the county agents and other agencies which are in position to know of the farmers' difficulties and to anticipate their needs.

Unusual vigilance might well be exercised to see that proper tillage is given, that the heaviest yielding or best adapted varieties are employed, and that improved methods are followed so far as these are known. In some cases investigations can be "speeded up" or at least brought to a point where their conclusions and important teachings can be made use of, leaving the more elaborate details to be completed later. The unpublished information of the stations should be brought together and digested, with a view to getting out any facts likely to have special practical importance. High prices will stimulate the farmers to greater effort toward enlarged production and will frequently warrant the employment of practices which are not now general. Unusual conditions and exigencies will justify unusual methods.

The stations can fill a useful place by putting themselves keenly on the alert, bringing their knowledge and their vision to bear in a broad way on the agriculture as carried out in their region, in order to instruct properly the county agents and other advisers of the men in the field. It will be especially desirable to maintain through them a close contact with agricultural practice, and above all to be found ready for cooperation with other agencies in lines which are within their field.

It will be well to keep an unusually sharp lookout for both old and new or unidentified crop enemies or other difficulties. And in this direction the stations can exercise their vigilance and place themselves in position to lend aid and advice promptly. The large losses which are to considerable extent preventable need to be avoided or reduced to the minimum this year. The large amount of study in this country which has made possible more effective control and precautionary measures should now be made available and put into wide operation. Special effort will often be needed to accomplish this,

which can be stimulated and aided by the stations, and they can see to it that failure is not due to lack of placing the knowledge and the means properly before the extension and other publicity agencies. The very fact of unusual efforts at extending agricultural production, often with a diminished or less expert labor supply, will make it increasingly necessary that aid be given in overcoming obstacles which may appear and in seconding the efforts of the extension forces by the best advice and expert assistance that is to be had. Quite frequently, no doubt, the assistance rendered will be in the nature of an experimental demonstration, and its results may be found of intrinsic value as an additional test of the actual efficiency of protective measures.

To some extent also investigation can doubtless be shaped to meet special immediate needs. It will be necessary to conserve supplies of fertility and feed as well as of human foods. Some studies may be needed of waste and bad practice, as a foundation for advice for correcting it.

In some cases the stations may render a special service by averting disaster from well-meaning but poorly advised attempts which may be made by others to aid the farmers. When so many agencies are offering advice and suggestions, there is an element of danger unless some means of discrimination is at hand which will insure the farmers protection from some of their would-be friends. The present is above all a period for safe and sane advice resting on demonstrated knowledge. It is no time to experiment with the farmer or to encourage him to experiment in methods or enterprises of uncertain outcome. To supply the basis for this sound advice and procedure is the function of the experiment stations primarily, working through the extension divisions, the county agents, and similar agencies.

In general, the activities of the stations may be to a considerable extent directed to taking hold of those things which tend to increase production, conservation, and the maintenance of the resources on which production rests. This does not necessarily mean that established lines and projects are to be abandoned or left to take care of themselves, but that these may be adjusted as far as possible to other work which is in the nature of exigency. And, above all, the stations should be ready to adapt themselves to the special needs of the hour and fully alive to their opportunity as well as to the general necessity.

The war has already directed attention as never before to the intimate relations between science and industry, including agriculture, as well as to the vital necessity of fostering these relationships. In England especially, agitation along these lines has been strong and continuous. Nearly two years ago Sir William Ramsay, in an address before the British Science Guild on the national organization of

science, pointed out the need of a vigorous support of scientific research as a war measure. In this he embodied a warning by Dr. Lyon Playfair, sixty-three years previously, in which the latter deplored the holding "to mere experience as the sheet anchor of the country, forgetful that the molds in which it was cast are of antique shape, and ignorant that new currents have swept away the sand which formerly held it fast, so that we are in imminent risk of being drifted ashore."

The publication by the Board of Agriculture and Fisheries of a comparative study of British and German agriculture served to call sharp attention to the lower food producing power of British agriculture and the far smaller efforts given to promoting agricultural instruction and experimentation. In this paper it was shown that although the soil and climate of Germany are the less favorable to agriculture, one hundred acres of land in that country feeds from seventy to seventy-five persons as compared with only forty-five to fifty persons in Great Britain. This advantage of Germany has come about within the last forty years. Various causes are assigned for the change, but a great deal is attributed to the system of agricultural education and research. Thus, the use of artificial fertilizers has largely increased, and according to the article, "the chief factor in developing the use of artificial manures in Germany was unquestionably a well-organized system of technical education. Investigation at the research stations established the precise uses of these manures; trustworthy advice was supplied by institutions, by peripatetic instructors, by technical leaflets, and by agricultural newspapers; and the farmer, even the backward Bauer, like other Germans, brought his methods into line with 'Authority.'" Similar testimony has recently been given by Professor von Rümker of the Royal Agricultural High School of Berlin, who states that "the great progress that agriculture has achieved in Germany during the last quarter of a century is the result of the union of practice with science."

Early in the present year an important letter from Lord Blyth appeared in the *Times*, emphasizing the necessity for the close coordination of science with practice in agriculture for the purpose of increasing food production of the country. He proposed the immediate appointment of a commission of men of science to devote its entire attention to research and experimentation. *Nature* reported on January 25 that the formation of such a commission was under consideration and expressed its approval of the undertaking. "Throughout the war," it went on to say, "the agricultural colleges and experiment stations have rendered useful service and have demonstrated more convincingly than ever the close connection between science and agriculture. Indeed, never before has agricultural science had so much recognition as now, either from farmers or from

men engaged in pure science, and it is hoped that the new conditions will do much to strengthen still further the development of scientific agriculture in this country."

The movement toward the fostering of industrial research seems to be extending to all parts of the British Empire. The Canadian Government has appointed an honorary advisory council on scientific and industrial research to advise a cabinet committee (including the minister of agriculture) on all matters relating to the extension and coordination of scientific and industrial research. Considerable special development along experimental and demonstration lines in agriculture is also reported from the Dominion. An experimental flax mill has been erected at the Central Experimental Farms, where experimental work is to be begun with a view to developing the industry, and research laboratories are being established in Manitoba and Saskatchewan for emergency studies of grain rust.
Ontario, where marked efforts are being made to increase land settlement, an agricultural training depot is being organized at one of

In Northern Ontario, where marked efforts are being made to increase land settlement, an agricultural training depot is being organized at one of the experimental farms for the instruction of returning soldiers, as well as several demonstration farms, a plant breeding station, and an agricultural high school. One interesting phase is the utilization of the labor of interned aliens in this section and also in Quebec for the clearing of timberland for eventual use as an experimental substation.

The South Australian branch of the British Science Guild has drawn up plans for a federal institute for original research, designed to give special attention to agriculture and to undertake "research work beyond experimental farming." The guild has realized the importance of studying from a research point of view everything underlying the successful use of the land, including the wellbeing in every respect of the people engaged in farming operations. Its ideas were presented to the Australian premiers, and it is understood that energetic steps are being taken to put some such a plan into effect. Problems relating to engineering, chemistry, coal mining, diseases of cattle, agriculture, bread making, and other matters are on the list in the federal research scheme being worked out by the executive committee of the Advisory Council of Science and Industry for the Commonwealth of Australia.

The French Academy of Science has proposed and recommended the establishment of national laboratories of scientific research, and a commission of the academy has dealt with the matter of institutions for research in agriculture. In a report presented to the academy toward the close of the last year, the important position of agriculture

is described, as well as the great desirability of increasing the farm production per hectare. The commission asserts that the entire system for agricultural encouragement, instruction, and research in France must be reconstructed "from the base to the summit," declaring that "it has been definitely shown that the countries which have made the greatest progress and which obtain from their soil the highest returns, are those which have increased the institutions of research and instruction of the highest rank, and have prepared their rural population to appreciate them, to accept them, and to have full confidence in science. The report asserts further that "all the great progress realized in the domain of agriculture has had its point of departure in the works and discoveries of science."

The commission describes in considerable detail the experiment station system of the United States, which it commends highly. This system is contrasted with the stations and laboratories in France, for which the government in 1913 voted 339,700 francs (about \$68,000), with very small additional revenues from local and similar sources. This sum is shown to be quite inadequate, and to result in limiting the field work and expensive investigations and in restricting considerably the routine functions.

At present the French station is usually devoted to a single branch of industry. The commission argues for fewer stations located in typical agricultural areas and well organized to cover the various phases of the industries, with specialists in each. It is also suggested that the stations should seek the collaboration of farmers, much as have the Danes in their experimental work.

What the commission regards as very serious obstacles are the comparative isolation of the stations from one another and their lack of central supervision. It advocates the appointment of a permanent superior council to guide and direct the work of the stations, assure the proper use of the funds at their disposal, provide for meetings of their personnel from time to time, publish results of their work and abstracts of material of interest appearing elsewhere, and otherwise correlate and unite the scattered institutions into a national system. The establishment of a well equipped central station charged with work of a strictly scientific nature of interest to the whole country, or of such scope and importance that it could not be carried on to the best advantage at the regional stations, is also favored.

The entrance of the United States into the war is of course too recent for extensive developments, but attention may be drawn to the appointment of an agriculture committee of the National Research Council and the active participation of agricultural leaders in the many conferences and compaigns which are the order of the day.

Special mention should be made of the St. Louis conference of April 9 and 10, called by the Secretary of Agriculture and participated in by representatives of the Department and sixty-five officials from the agricultural colleges of thirty-two States and twenty State departments of agriculture. Among the many recommendations of this conference was one for the appointment of two national bodies, one relatively small and to be composed of men of wide knowledge of agricultural matters and executive experience for quite constant service in Washington, and the other a large national advisory body of representatives of the leading agricultural agencies and related interests.

The Federal Government has already organized an interdepartmental committee to formulate a program for food production and conservation, and has a number of plans under consideration. Among these is the material expansion of the work of the Department of Agriculture, enlarging its forces for cooperative demonstration work, home economics, the combating of destructive pests, the utilization of methods for the preservation of perishable products, the safeguarding of seed supplies for 1918, the market news service, assisting with the labor problem, and otherwise to stimulate production, improve distribution, and promote conservation of the food supply. The appointment of a small body of agricultural leaders to give advice as regards national problems, and the creation in each State of a small central division of food production and conservation composed of representatives of the various agricultural and related interests, as well as the formation of county, township, or urban bodies of similar constitution to work in close cooperation with the State central agency, are also suggested. It is estimated that approximately $25,000,000 will be required to carry these plans into operation.

In this brief review no attempt has been made to present a complete summary of the existing situation. The aim has been rather to cite some suggestive illustrations of the importance being attached in this great world-crisis to the close coordination of the science and practice of agriculture. It is scarcely necessary to point out that this means for all agricultural research institutions an unusual opportunity for service and a corresponding responsibility.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Preliminary notes on the carbohydrates of the Musci, T. G. Mason (*Sci. Proc. Roy. Dublin Soc., n. ser., 15 (1916), No. 2, pp. 13–28, fig. 1*).—In the examination of *Polytrichum commune*, *Thuidium tamariscinum*, and *Sphagnum cymbifolium*, the author found dextrose, levulose, and sucrose present, while maltose was found to be dependent on the presence of starch. Invertase was found to be widely distributed, while diastase and maltase were found in *P. commune* alone. The detection of diastase and maltase was dependent on the presence of appreciable quantities of starch. In *P. commune* and *S. cymbifolium* the hexoses appear to be the chief form in which the carbohydrates descend the stem. In regard to the necessity of a high concentration of hexoses for the synthesis of sucrose by the invertase, it is indicated that "though the experiments quoted in this work exclude the possibility of a high concentration for the whole leaf, yet they do not demonstrate the absence of a localized high concentration."

It is concluded that "the factors that operate in bringing about the synthesis of sucrose in the plant cell are still very obscure" and that it is improbable that invertase in aqeous solution possesses this property.

The destruction of pentoses in the course of alcoholic fermentation, H. Pellett (*Compt. Rend. Acad. Sci. [Paris], 163 (1916), No. 11, pp. 274–276*).—In a study of the composition of molasses the author found, contrary to the general assumption, that arabinose and xylose were decomposed by yeast when present in a mixture of fermentable sugars, the quantity destroyed depending upon the amount of yeast, the temperature, and the length of fermentation.

For destroying the easily fermentable sugars so that the pentoses may be determined by copper with reduction, 50 gm. of ordinary pressed yeast in a solution containing 100 gm. molasses should be used. The fermentation is usually complete in 24 hours without any decomposition of pentoses.

Applying the method to molasses the author found the material to contain no appreciable quantities of pentoses but a nonfermentable substance which is indicated as probably being the material "glutose," described by earlier investigators.

The mode of action of plant peroxidases, G. B. Reed (*Bot. Gaz., 62 (1916), No. 3, pp. 233–238, figs. 2*).—Experiments similar to those reported in a study of the platinum reaction previously noted (E. S. R., 35, p. 713) have been repeated, using horse-radish root extract and potato peroxidase.

The experiments have shown that just as the platinum is recharged with oxygen by hydrogen peroxid as soon as some of the oxygen has been removed from the platinum by a reducing agent, so the horse-radish and potato peroxidase is recharged by hydrogen peroxid under similar conditions. It is concluded that "in oxidation processes catalyzed by peroxidases two reactions are involved. The peroxidase combines with oxygen from the oxygenases (or from hydrogen peroxid, or possibly from some other source, since it is capable of tak-

ing it from potassium permanganate) to form an intermediate compound which is a more energetic oxidizing agent than the original source of the oxygen. The final stage in the oxidation is then effected by this intermediate compound."

The relation between oxidase and catalase in plant tissues, G. B. REED (*Bot. Gaz.*, *62* (*1916*), *No. 5, pp. 409-412, fig. 1*).—The juice of the pineapple in three stages of ripeness (quite ripe and soft, yellow but not soft, and still partly green) was examined for catalase, and the enzym found to be present in the ripe fruits, with the greatest amount in the juice of the overripe but not in the green fruit. The juices from all of the fruits, however, showed approximately the same peroxidase activity. From the study with platinum black noted above and from the fact that in certain stages of their development pineapples contain oxidases but no catalases, the author concludes that "the substances which effect the decomposition of hydrogen peroxid are not of necessity concerned with the enzyms which accelerate peroxid oxidations. It may be added that the fact that catalase is not universally present in living cells, as Loew [E. S. R., 13, p. 115] and others suppose, has considerable theoretical interest."

The elasticity of the coagulum produced in cows' milk by rennet, O. ALLEMANN and H. SCHMID (*Landw. Jahrb. Schweiz*, *30* (*1916*), *No. 3, pp. 357-383, figs. 2*).—A simple apparatus for determining the elasticity of milk curd, which depends on measuring the resistance offered to the withdrawal from the coagulated material of a device of three concentric rings attached to a vertical axis, is described in detail.

Because of the great importance of the elasticity of the curd in the manufacture of cheese, the authors studied, with the aid of this apparatus, the effect of various factors on this property in the coagulation of milk. The results showed that from the beginning of the coagualtion the elasticity of the curd increased in direct proportion with the time. Variations in the amount of rennet used, other conditions being the same, produced a direct increase in the elasticity, depending on the amount used. For example, using double the quantity of rennet in a given volume of milk the elasticity of the curd was doubled. The elasticity of the curd also varied directly with the increase of the acidity of the milk, and likewise with the addition of calcium chlorid. The addition of ammonia, however, did not have the exact reverse effect from that of the acid, but, apart from decreasing the acidity, it appeared to exert a detrimental effect on the enzym.

An increase in temperature to a maximum of 41° C. increased coagulation time. The elasticity of the curd was also directly proportional to the temperature increase, with no apparent maximum. Agitation of the material retarded the coagulation time on an average of about 8 per cent. Previous cooling caused some delay in the time of coagulation, and also a diminished elasticity of the coagulum.

The greatest factor influencing coagulation by rennet was found to be the individuality of the milk. Great variations were observed, not only in the coagulation time but also in the nature of the curd formed. The period of lactation affected the coagulation time in that shortly after calving the time increased, rapidly sinking, however, to a minimum, then again increasing in a few days and remaining fairly constant. No apparent difference was observed either in the coagulation time or nature of the curd produced by the morning or evening milk of individual animals, nor did the feeding of various rations produce any perceptible change. The milk from cows in œstrus coagulated much slower and produced a curd of reduced elasticity. Similar variations were occasionally observed in the milk of animals which had been subjected to sudden climatic changes.

A contribution to the bacteriology of silage, J. M. Sherman (*Jour. Bact., 1 (1916), No. 4, pp. 445–452*).—The author, at the Pennsylvania Experiment Station, has observed the presence of large numbers (over a billion per cubic centimeter of juice) of organisms which, though closely related to the *Bacillus bulgaricus* group of milk and the *B. acidophilus* group of the intestines, appear to differ somewhat from the typical members of these groups, notably by the abundant growth on ordinary laboratory media. It is indicated that silage made from corn is always amply seeded with these organisms, since the aciduric bacilli of silage are constantly found in large numbers on corn fodder.

See also a previous note by Hunter and Bushnell (E. S. R., 35, p. 9).

Minutes of evidence taken before the Committee on Edible and Oil-Producing Nuts and Seeds (*London: Colonial Office, 1916, pp. 233*).—A detailed account of the evidence presented to the departmental committee appointed by the Secretary of State for the Colonies to investigate the edible and oil-producing nut and seed industry in West Africa and to make recommendations for the promotion of industries dependent thereon.

Report of Committee on Edible and Oil-Producing Nuts and Seeds; with a despatch from the Secretary of State for the Colonies (*London: Colonial Office, 1916, pp. 47*).—This reports the findings of the committee from the minutes of evidence as noted above.

Watermelon seeds from the Sudan (*Bul. Imp. Inst.* [*So. Kensington*], *14 (1916), No. 2, pp. 160–162*).—A sample of watermelon seeds (*Citrullus vulgaris*) was found to contain 7.4 per cent moisture and 23.6 per cent of a brownish-yellow oil. The oil yielded the following constants: Specific gravity at 15° C., 0.923; solidifying point of fatty acids, 30.5°; acid value, 8.4; saponification value, 191.4; iodin value, 117.1; Hehner value, 95.1.

The press cake was found to have the following percentage composition: Moisture, 9.5; protein, 18.3; fat, 0.5; starch (by difference), 26.9; fiber, 41.9; ash, 2.9. From these figures the percentage composition of the original seed was calculated and found to be moisture, 7.4; protein, 14; fat, 23.6; starch, 20.6; fiber, 32.2; and ash, 2.2.

The value of the oil and the economic importance of its source is indicated. The press cake is regarded as of little value because of its high fiber content.

The essential oil of Cinnamomum oliveri or Brisbane sassafras, G. W. Hargreaves (*Jour. Chem. Soc.* [*London*], *109 (1916), No. 646, pp. 751–754*).—The oil distilled with steam from the bark and fractionally redistilled under diminished pressure was found to contain approximately the following percentage constituents: Pinene, from 12 to 15; *d*-camphor, from 18 to 20; safrole, from 25 to 27; and eugenyl methyl ether, from 45 to 45. The percentage composition of the oil of the leaves was found to be pinene and phellandrene (?), 25; *d*-camphor, 60; and phenols and other substances, 15.

The analytical data are described in detail.

A method for the estimation of very small amounts of potassium, H. J. Hamburger (*Biochem. Ztschr., 74 (1916), pp. 414, 415; abs. in Jour. Chem. Soc.* [*London*], *110 (1916), No. 646, II, p. 448*).—The author calls attention to an error in the capillary tubes used and described in the method for the determination of potassium previously noted (E. S. R., 34, p. 503). With a correctly graduated tube each division equals 0.0004 cc. and corresponds to 0.000074059 gm. of potassium.

A new, rapid, and accurate method for estimating lime and potash in soils, T. E. Keitt and C. J. King (*South Carolina Sta. Bul. 188, pp. 3–5*).—The method described is as follows:

An aliquot of the soil solution corresponding to 2 gm. of soil is evaporated in a platinum dish on a water bath after the addition of 5 cc. of sulphuric acid

(1 : 1). The evaporation is completed on a sand bath and the residue ignited at blast-lamp temperature to convert the iron and aluminum salts present into the insoluble oxids. The residue is treated with 25 cc. hot water, washed by decantation, and finally on the filter until free from sulphates. The filtrate is then evaporated to about 50 cc. volume and, after making the solution alkaline with ammonium hydroxid, the calcium is precipitated in the boiling solution by a saturated solution of ammonium oxalate. After allowing to stand for at least three hours the solution is filtered and reprecipitated according to the official method for determining calcium in soils. The filtrate and washings from the calcium determination are evaporated to dryness, the ammonium salts removed, and the potash determined according to the official Lindo-Gladding procedure (E. S. R., 20, p. 512).

Comparative analytical data submitted indicate the accuracy of the procedure.

Advantages claimed for the new method are a considerable saving of time, the rapid removal of soluble salts from the iron and aluminum precipitate by hot water, and the regulation of the amount of reagents used, thus avoiding their removal later in the procedure.

The ammoniacal nitrogen of peats and humus soils, J. C. B. Ellis and C. G. T. Morison (*Jour. Agr. Sci.* [*England*], *8* (*1916*), *No. 1, pp. 1–6*).—The authors have found that distillation with magnesium oxid by a slightly modified procedure, described in detail, yields fairly constant results for ammonia with the same sample of peat. This amount is many times greater than that yielded in the case of arable soils. Much of the ammonia can be removed by water alone, but no constant ratio has been found between this amount and that obtained by direct distillation. These respective amounts may vary considerably with the depth from which the sample is obtained.

The nature and source of this ammoniacal nitrogen and the conditions of its solubility in the soil water are being studied.

The reaction between dilute acids and the phosphorus compounds of the soil, E. J. Russell and J. A. Prescott (*Jour. Agr. Sci.* [*England*], *8* (*1916*), *No. 1, pp. 65–110, figs. 20*).—The extraction of phosphorus from soils by acids and the adsorption of P_2O_5 in the presence of acid are discussed in some detail. Experimental data obtained by the extraction of soils with dilute nitric, hydrochloric, sulphuric, and citric acids are submitted in graphical form. The effect of the time of extraction, strength of acid, and temperature were also studied.

When a soil is shaken with a dilute acid in the process of analysis " the acid dissolves out such phosphorus compounds as it can, and different acids have much the same effect at equivalent concentrations; nitric, hydrochloric, and citric acids give the same results; sulphuric acid, however, gives a somewhat higher result. A reverse reaction at once sets in, however. Some of the P_2O_5 is withdrawn from the solution in spite of the presence of excess of acid. The process is an ordinary adsorption and obeys the usual law. . . . Its extent varies with the different acids; it is much more marked in the presence of nitric than of citric acid." The amount of phosphorus actually determined in a soil extract is, then, not the true amount dissolved but the difference between the two wholly distinct actions.

This reverse reaction explains why the " available P_2O_5" determined by extraction with dilute acids shows such variations in different methods of analysis and so little correlation with the actual quantities used by the crops. The results indicate nothing definite but simply a difference between a direct action and an adsorption which varies with the nature of the acid and the conditions of the experiment.

It is indicated that a comparison of results with similar soils is useful, but that a comparison of dissimilar soils would involve difficulties. The proper way to use a soil analysis is in conjunction with a soil survey.

A diffusion method in which the reverse reaction is eliminated during acid extraction, thus yielding a true measure of the direct solubility action, is described.

Notes on the nature of the phosphates contained in mineral phosphates, G. S. ROBERTSON (*Jour. Agr. Sci.* [*England*], 8 (*1916*), *No. 1, pp. 16–25, figs. 2*).—The results obtained from the examination of five different mineral phosphates indicate the presence of three distinct compounds of phosphoric acid and calcium oxid. The formulas of the compounds are submitted.

It was found that the substitution of fluorin or chlorin for the oxygen of one of the CaO groups in the rock phosphates examined did not interfere with the ratio P_2O_5 : CaO. It is indicated that the combination of fluorin or chlorin in this manner would account for the low solubility of rock phosphates in citric acid as compared with bone meal, while the higher lime content of the phosphates would account for their higher solubility in citric acid as compared with apatite. "The results of calcining the various mineral phosphates show that a citric-soluble silica phosphate is formed. This phosphate goes into solution in the first citric extract. In addition to the silica phosphate one or more phosphates with a lower lime content than the original phosphate are produced by calcining. The longer the calcining continues the greater is the tendency to produce phosphates of low lime content, and hence the lower the solubility."

It is further noted that the higher the percentage of lime actually combined with phosphoric acid, the more soluble the mineral phosphate is in citric acid.

Note on the loss of phosphoric acid during fusion with ammonium fluorid, W. A. DAVIS and J. A. PRESCOTT (*Jour. Agr. Sci.* [*England*], 8 (*1916*), *No. 1, pp. 136–138*).—Experiments with sodium acid phosphate, potassium diacid phosphate, calcium phosphate, and apatite have shown that on ignition with ammonium fluorid a considerable loss of phosphoric acid may occur. The loss is least in the case of salts containing an alkali metal, and greatest in the case of phosphates of the alkaline earth metals, as calcium phosphate or apatite. It is indicated that the phosphorus is probably volatilized in the form of phosphorus fluorid.

Estimation of calcium in ash of forage plants and animal carcasses, S. B. KUZIRIAN (*Iowa Sta. Research Bul. 32* (*1916*), *pp. 99–110*).—The following modified procedure is proposed:

The filtrate (acid with nitric acid) from the precipitation of phosphorus as ammonium phosphomolybdate is made ammoniacal and an excess of ammonium oxalate added. The solution is brought to boiling and kept so for 30 minutes, set aside for two hours, and filtered through a Gooch crucible. The precipitate is ignited to convert the oxalates into oxids and cooled rather rapidly by allowing to stand in the air. The contents are then carefully moistened with water over a beaker and dissolved in dilute hydrochloric acid. The contents of the crucible, together with the asbestos, are carefully washed into the beaker, the latter is covered with a watch glass and gently warmed on a water bath or hot plate, and after complete solution filtered through ashless paper and the asbestos carefully washed. Ammonium chlorid is added, and the solution made ammoniacal and boiled for a few minutes until the odor of ammonia becomes faint. The precipitated iron and aluminum are removed by filtration, the filtrate heated to boiling, and the calcium precipitated as oxalate. The calcium is entirely free from molybdenum salts at this stage of the process.

Experiments in which the excess of molybdenum was removed as sulphid showed this step to be of no advantage either in the determination of calcium or in the complete ash analysis.

A comparison of the proposed procedure with the official basic acetate method (E. S. R., 20, p. 512) shows that the new method yields more accurate and concordant results and does not require exact neutrality of the solution. The filtrate from the phosphorus precipitation is small enough so that no evaporation is necessary, the time required for the determination is greatly shortened, and phosphorus and calcium may be determined in the same aliquot.

The basic acetate method is reviewed and certain difficulties encountered by the author in securing concordant results in the later determination of manganese, calcium, magnesium, and the alkalis are pointed out.

Some analytical data of the calcium in the ash of pig carcasses are submitted.

A new limestone tester, C. G. Hopkins (*Illinois Sta. Bul. 194* (*1917*), *pp. 487–495, fig. 1*).—A limestone tester much simpler than the one previously noted (E. S. R., 34, p. 806) and its manipulation are described in detail. The test consists essentially of converting a weighed sample of the limestone into calcium chlorid with dilute hydrochloric acid saturated with carbon dioxid and determining the loss in the reaction. The percentage of calcium carbonate in the original sample is then easily determined by a simple calculation.

Tables showing milligrams of carbon dioxid per cubic centimeter of saturated gas and weight of dry air in milligrams per cubic centimeter of saturated atmosphere, together with some brief notes on limestone samples and the use of limestone for soil improvement, are submitted.

The determination of humus by means of a simplified procedure of elementary analysis, A. I͡akobsen (*Zhur, Opytn, Agron.* (*Jour. Agr. Expt.*), **17** (*1916*), *No. 2, pp. 93–98, fig. 1*).—A combustion method for the determination of humus in soils, in which platinized asbestos is used as the catalyst, and its manipulation are described in detail. Oxidation with from 1 to 2 gm. of material can be effected in from 25 to 30 minutes, and the results obtained are identical with those obtained by the procedure of Gustavson.

Advantages claimed for the modified procedure are rapidity of combustion, economy of materials, and simplicity in manipulation.

The estimation of carbohydrates.—V, The supposed precipitation of reducing sugars by basic lead acetate, W. A. Davis (*Jour. Agr. Sci.* [*England*], *8* (*1916*), *No. 1, pp. 7–15*).—Continuing previous studies (E. S. R., 33, p. 712), the author submits results which show that, at least in dilute solutions, levulose is never precipitated by basic lead acetate, even in the presence of chlorids, sulphates, or carbonates. There is no loss of levulose unless the excess of basic lead acetate is allowed to act for some length of time on the sugar before the lead is precipitated. Only a slight excess should be used in the defecation of the sugar solution and this excess removed as soon as possible after the precipitation is complete.

It is indicated that basic lead acetate is more effective as a clarifying agent than is normal acetate, and if it is "added carefully in small quantities at a time until the precipitation of the impurities is just complete and the actual excess of the basic lead acetate solution is not allowed to exceed about 5 cc. in 300 to 500 cc. of the solution, there is no loss whatever of levulose or other reducing sugars."

New contributions to the analysis of milk, E. Ackermann (*Schweiz. Apoth. Ztg.*, *54* (*1916*), *No. 42, pp. 573–578*).—Tabular data of the total solids, lactose, lactose-free solids, and refractive index of the serum of normal cows' milk,

milk from animals affected with mastitis, and normal milk diluted with various percentages of water are submitted.

The data show that in normal milk the amount of lactose is usually greater than the amount of lactose-free solids. In animals affected with mastitis the amount of lactose is diminished in the majority of cases, while the amount of protein remains normal. With the addition of water to the milk the amount of the two components diminishes proportionally.

It is indicated that if the amount of lactose alone is abnormal and the lactose-free solids are normal it should not be concluded that the milk is watered, but rather that it comes from an animal or animals affected with mastitis. A table giving the refractive indexes of milk serum at 17.5° C. and from 16 to 41.9° and their respective percentages of lactose is included.

The composition of cottonseed meal and cotton seed, G. S. Fraps (*Texas Sta. Bul. 189 (1916), pp. 5–79*).—This bulletin discusses the composition of cottonseed meal sold in Texas and other States, describes and discusses the method of milling, discusses the effect of milling on the composition of the meal, describes and discusses methods for estimating hulls in cotton seed and for calculating yields of oil and meal from the composition of the seed, and proposes a method for estimating lint on cotton seed, as follows:

About 10 gm. of the whole seed is treated in a beaker with 15 cc. of concentrated sulphuric acid and the contents stirred continuously and thoroughly with a glass rod until all the lint, with the exception of a very little on the tip of the grain, is dissolved. The time for this solution is noted. The seeds are then separated from the excess acid by filtration on a perforated porcelain plate or filter and washed with tap water. They are then spread on ordinary paper and dried for 30 minutes in the steam bath, allowed to remain exposed to the air overnight, weighed, and the percentage of "dissolved lint" calculated. The time of contact with the acid should be reported with the percentage of lint.

Considerable analytical data as regards the composition of the whole seed arranged by location and by varieties, press cake, hulls, etc., are submitted in tabular form.

Conservation of fruit, fungi, truffles, and vegetables, R. Forlani (*Conservazione delle Frutta, dei Funghi, dei Tartufi, e degli Ortaggi. Rocca San Casciano, Italy: Licinio Cappelli, 1915, pp. 207, figs. 7*).—This volume discusses the subject under the following general topics: The harvesting of fruit; conservation in the fresh state; conservation of fruit in the cold; conservation in a dry state; desiccation of oily fruit, etc.; desiccation of vegetables; conservation of fruits and vegetables by sterilization; conservation of fungi and of truffles; and the preparation and industry of green olives.

METEOROLOGY.

Report of the chief of the Weather Bureau, 1916 (*U. S. Dept. Agr., Weather Bur. Rpt. 1916, pp. 282, pls. 4*).—This contains (1) an administrative report summarizing the work of the Weather Bureau during the year, (2) a review of weather conditions during 1915 including also sections giving detailed data on sunshine and excessive precipitation, and (3) monthly and annual summaries of pressure, temperature, precipitation, and related data for 1915, and of monthly and seasonal snowfall for 1915–16.

"The most pronounced weather conditions of the year 1915 were the unprecedentedly low temperatures in the southeastern part of the country during the entire month of March, and the unseasonably cool weather over the great cereal and grass-growing States from the middle of May to the last of August. Crop

conditions were generally favorable, except that the growth of corn was greatly delayed by the long-continued cool and wet weather, especially over the northern tier of States, and as a result much of the crop in those districts was injured by frost. The small-grain crops, however, were among the best ever grown, wheat especially making a record yield."

The present and proposed work of the division of agricultural meteorology established February 21, 1916, is quite fully explained. "While a number of new lines of work will be undertaken in this new division, the bulk of its work at the present time comprises former activities now brought together, coordinated, and improved. . . . The division is to conduct investigations of the effect of weather and climate upon the growth and yield of crops and will control the distribution of frost warnings and forecasts to special agricultural interests, conduct studies for the protection of crops and orchards from frosts, and, in general, supervise the activities of the Weather Bureau which relate to agriculture and which are comprised in a number of special services," as follows: Corn and wheat region service, cotton region service, sugar and rice region service, special fruit region service, special tobacco service, special cattle region service, special alfalfa service, and special temperature and storm warnings for sheepmen.

"Studies are going on as to temperature variations at different altitudes in North Carolina, Oregon, Colorado, and Ohio, and investigations have been continued in connection with temperature and frost forecasts for the benefit of those fruit growers who are heating their orchards, and information has been gathered as to the value of these heaters and the expense of orchard protection. . . . Studies to determine the critical period of growth of corn, potatoes, wheat, hay, fruit, and other crops by mathematical and graphical correlation methods" are being continued. Aid has been given the Massachusetts Experiment Station in a study of the weather conditions at different elevations and their effect upon the apple crop and of the relations between inversions in temperature and the development of peach buds.

Preliminary steps have been taken to secure the cooperation of the States generally in determining "the critical period of crops and the weather that has the greatest effect on crop yields, as well as on the extent of insect and fungus damage. It is expected that a definite and extensive system for keeping regular records of the different weather factors and the development of the most important crops will be instituted at a large number of these stations, and such preliminary work started as may be continued through a series of years, and from which large results may be anticipated."

Report of the meteorological station at Berkeley, California, for the year ending June 30, 1915, W. G. Reed (*Univ. Cal. Pubs., Geogr., 1 (1917), No. 10, pp. 441–504, figs. 14*).—The results of observations on pressure, temperature, precipitation, etc., are presented in detail for the year.

The average pressure for the year was 30.01 in., about the average for the 28 years of record at this place. The mean annual temperature was 57° F., practically the average for Berkeley. The highest temperature was 94°, September 10; and the lowest, 36°, December 8. The greatest daily range was 41° September 10. September and October were the warmest months, and December was the coldest. Frost was observed on 11 mornings in December and on 3 in January. The total precipitation for the year was 30.95 in., 16 per cent above the average. The total number of days with measurable precipitation was 87, about 30 per cent above the average. The percentage of clear days was 44, of partly cloudy 25, and of cloudy 31. The greatest precipitation on any rainfall day was 1.4 in. Practically all the wind was from a southerly or westerly direction.

Rain and snowfall of Canada, 1903–1913, R. F. STUPART (*Ottawa: Govt., 1914, pp. 207*).—The rainfall and snowfall records published in the annual reports of the Meteorological Service of Canada for the years 1903 to 1913, inclusive, are reprinted and bound together in this report.

Temperature observations during the year 1914, ELIZABETH STEPHANSEN (*Ber. Norges Landbr. Höiskoles Virks., 1914–15, App., pp. 29, figs. 3*).—Daily readings of temperature at Aas, Norway, during 1914 are compared with normals for the period 1874 to 1914. The temperature of the soil at depths of ¼, ½, and 1½ mm. is compared with that of the air.

Temperature changes due to terrestrial radiation and relation of the latter to plant growth, G. ROSTER (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 13 (1916), No. 1, pp. 1–27; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 7, pp. 934, 935*).—This article discusses the question of the placing of thermometers in the open air in order to get readings which are truly representative of the actual temperature conditions to which plants are subjected, and various observations are reported which indicate the wide differences in temperature which may be due to comparatively small differences in the position and elevation of the thermometers. For example, it was observed that a thermometer placed under the dense shade of a carob tree showed minimum temperatures 3 to 4° C. higher than those of a thermometer in the open air. A thermometer 20 in. above the ground receiving all the heat of direct solar radiation as well as soil radiation showed a daily range of temperature approximating 40°. Observations with two thermometers, one 20 in. above the ground and unprotected and the other 55 in. above the ground but protected from the sun and terrestrial radiation, showed the minimum daily temperature in case of the thermometer nearest the ground. The annual mean of 470 observations was 19.2° for the higher thermometer and 16.6° for the lower. The absolute minimum for four years was 11.6° for the first and 6.4° for the second. The monthly mean difference of temperature was 2.3° and the absolute maximum difference was 5.4°.

It is held that "these results prove beyond question the importance of the study, in connection with vegetation, of the temperature changes due to terrestrial radiation, which are perfectly distinct from the general cooling of the atmosphere and occur in the lower air strata, the medium of plant life."

SOILS—FERTILIZERS.

Agricultural geology, R. H. RASTALL (*Cambridge, Eng.: University Press, 1916, pp. IX+331, figs. 51*).—The purpose of this book is to supply information on those parts of geology which are of direct interest to the agriculturist. The most space is devoted to a study of the soil, and this is treated primarily from the geological standpoint. The later chapters of the book contain a summary of the distribution of the rock formations of the British Isles and the characters of the soils yielded by them.

On taking samples of soil for soil surveys, E. J. RUSSELL (*Jour. Bd. Agr. [London], 23 (1916), No. 4, pp. 342–349*).—General information on points to be considered in taking soil samples for surveys of English soils are given.

[Soil studies], F. W. MORSE (*Massachusetts Sta. Circ. 64 (1916), pp. 3*).—This circular is intended to supplement Circular 45 of the station (E. S. R., 32, p. 321), and describes a plan by which county agents of the extension service can cooperate with the station in making soil examinations more serviceable. It is considered especially desirable to compare the texture and composition of soils of known value for special crops with those of soils believed to have similar possibilities. A method of sampling with a soil auger to be uniformly used is described, and an outline of factors useful in soil classification is given.

Soil survey of Yell County, Arkansas, E. B. DEETER and C. LOUNSBURY (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 41, fig. 1, map 1*).—This survey, issued January 10, 1917, deals with the soils of a naturally well drained area of 603,520 acres in west-central Arkansas. A large proportion of the county includes mountains, and relatively broad, level to gently rolling intervening valley areas constitute the principal farming land. The upland soils, comprising more than 80 per cent of the area, are of residual origin and consist largely of loams, sandy loams, and stony loams. Including rough stony land and riverwash, 23 soil types of 12 series are mapped, of which the Hanceville stony loam, rough stony land, Hanceville loam, and Conway silt loam cover 33.2, 14.9, 14.8, and 12.1 per cent of the area, respectively.

Composition of Hawaiian soil particles, W. T. MCGEORGE (*Hawaii Sta. Bul. 42 (1917), pp. 12*).—A study of the composition of the coagulable and noncoagulable clay grains and an investigation on the composition of the clay, fine silt, silt, fine sand, and coarse sand separates in the important types of Hawaiian soils are reported. The origin of Hawaiian soils and the changes which these soils undergo during disintegration are also discussed.

A wide variation was found in the composition of soil particles of the same size from different Hawaiian soil types. This variation is attributed primarily to the number and intensity of action of the several weathering agents which are instrumental in the disintegration of the lava. "Iron, titanium, and manganese are present in largest amount in the coarse grains. Silica, alumina, and phosphoric acid predominate in the finest particles; lime and magnesia in the coarse grains. The influence of coagulants upon Hawaiian clays varies with the composition of the clay. Those most difficultly coagulable are higher in iron and silica than those readily coagulable."

Summary of Illinois soil investigations, C. G. HOPKINS, J. G. MOSIER, and F. C. BAUER (*Illinois Sta. Bul. 193 (1916), pp. 450–484, pl. 1, figs. 6*).—This bulletin summarizes the results of soil investigations which have been carried on in Illinois since 1901, including systematic soil surveys, chemical analyses, and cultural experiments. Illinois soils exist in 14 great soil areas and in the counties covered by the first 10 soil reports, 62 individual and extremely diverse soil types have been discovered and grouped into 6 classes as prairie, timber, terrace, ridge, swamp and bottom land, and residual soils.

"Fertility invoices of the individual soil types show a great variation in the content of the essential plant-food elements. Illinois soils may be deficient in one or more of five plant-food elements, namely, nitrogen, phosphorus, potassium, calcium, and magnesium, and they may be either acid or alkaline. Thus the problem of maintaining the fertility of the soil is sometimes complicated, though usually limited essentially to the application of limestone and phosphorus and the turning under of nitrogenous organic matter.

"As a rule, the results of the field experiments harmonize with the information given by the chemical composition of the soil. They have shown (1) that the maintenance of organic matter and nitrogen is the greatest practical problem of the Illinois farmer, (2) that phosphorus is the one element of plant food that is most universally deficient, and (3) that limestone must be supplied in abundance to many soils before they can be permanently improved. On the ordinary corn-belt soil, proper treatment has produced a total value for one rotation (1911–1914) of $98.58, as contrasted with $65 where no treatment was given. One dollar invested in rock phosphate has paid returns as follows: First rotation, $1.18; second rotation, $1.62; third rotation, $2.70. . . .

"Southern Illinois prairie land has been improved by proper soil treatment so that the total increase over untreated land has been 207 per cent. On peat soil, potassium has increased corn yields by more than 30 bu. per acre. On sand

soils during six years the value of the crops per acre has been increased $73.37 by nitrogen and only 22 cts. by phosphorus in addition."

A list of 34 available publications relating to Illinois soil investigations is appended.

Tazewell County soils, C. G. HOPKINS, J. G. MOSIER, E. VAN ALSTINE, and F. W. GARRETT (*Illinois Sta. Soil Rpt. 14 (1916), pp. 68, pls. 2, figs. 11*).—This is the fourteenth of the Illinois county soil reports.

Tazewell County is located a little north of the central part of the State, principally in the earlier Wisconsin glaciation. The general topography of the county is gently rolling with the exceptions of the northwestern and eastern parts, where small streams have broken the upland into a series of hills and valleys. Natural underdrainage exists over a large part of the gravel terrace. An area in the southwestern part of the county needs artificial drainage.

The soils of the county include (1) upland prairie soils rich in organic matter, (2) upland timber soils, (3) terrace soils, and (4) swamp and bottom lands, covering, respectively, 37.62, 24.91, 22.01, and 14.36 per cent of the area. The brown silt loam is the most extensive single type. "The most significant facts revealed by the investigation of the Tazewell County soils are the lack of limestone and the low phosphorus content of the common prairie soil and of the most extensive timber types, which combined cover nearly 60 per cent of the entire county."

The principal soil areas of Iowa, W. H. STEVENSON (*Iowa Yearbook Agr., 16 (1915), pp. 581–592, fig. 1*).—This report states that there are four distinct classes of soils in Iowa, geest, alluvium, loess, and till. The two latter are the most important, comprising about 93 per cent of the area of the State. There are three distinct areas of loess soil, the Missouri loess in western Iowa, the Mississippi loess in eastern Iowa, and the loess of southern Iowa. There are three distinct areas of glacial till, the Wisconsin, the Iowan, and the Kansan.

The principal soil problems of these different areas are as follows: (1) Drainage, which affects especially the Wisconsin drift area and the wide river bottoms, and in a lesser degree the Iowa drift area and the hilly Kansan drift area in southern Iowa; (2) treatment of the so-called alkali spots of the newer drift areas; (3) treatment to restore the fertility of the leachy areas of the loess and the Iowan drift area; (4) treatment of the gumbo, the geest, the ferretto, and the clay hills of southern Iowa according to the special requirements of the different cases; (5) prevention of soil erosion, which is the source of enormous loss to Iowa and a constant menace in the hilly regions; (6) treatment to cause the loess soils to warm up more quickly in the spring; (7) experiments to find the difference in productiveness shown by certain areas as regards certain crops and to find how these differences may be equalized; and (8) experiments to determine the most practicable system of crop rotation for each principal area.

Soil survey of Grenada County, Mississippi, W. E. THARP and J. B. HOGAN (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 32, fig. 1, map 1*).—This survey, made in cooperation with the State of Mississippi, and issued January 27, 1917, deals with the soils of an area of 284,160 acres in north-central Mississippi, the greater part of which consists of rolling to hilly uplands, in places very rough. The western end of the county lies in the Mississippi flood plain.

"The upland soils of the western and central parts of the county are of loessial origin. In the eastern half of the county the loess is seldom more than a few feet deep, and the underlying coastal plain material, consisting mostly of sand and clay, enters largely into the composition of the soils."

Including meadow, 14 soil types of 11 series are mapped, of which the Grenada silt loam, Lexington silt loam, and Vicksburg silt loam cover 24.9, 13.2, and 12.7 per cent of the area, respectively.

Soil survey of the Bitterroot Valley area, Montana, E. C. Eckmann and G. L. Harrington (*U. S. Dept. Agr. Advance Sheets Field Operations Bur. Soils, 1914, pp. 72, pls. 3, fig. 1, map 1*).—This survey, issued January 18, 1917, deals with the soils of an area of 327,040 acres in Ravalli and Missoula counties in western Montana. The valley area is a well marked depression of structural origin. The soils of the area have been derived from residual material, ice-laid and water-laid glacial material, old valley filling deposits, recent alluvial fan material, recent alluvium, and miscellaneous materials. Fifteen soil series, embracing 36 soil types, and two miscellaneous soils are recognized in the area. Of these, rough stony land covers 17.3 per cent, Bass stony sandy loam 9.1 per cent, Burnt Fork stony loam and Victor stony sandy loam each 7.8 per cent, and Waterloo sandy loam 6.5 per cent of the area.

Geology of Cincinnati and vicinity, N. M. Fenneman (*Geol. Survey Ohio, 4. ser., Bul. 19 (1916), pp. 207, pls. 14, figs. 59*).—This report contains physiographic data which may be of use in a study of the soils of Ohio.

Soil survey of Dorchester County, South Carolina, W. J. Latimer, J. M. Snyder, and C. Van Duyne (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 45, pls. 2, fig. 1, map 1*).—This survey, issued January 16, 1917, deals with the soils of an area of 362,240 acres in the Coastal Plain region of southeastern South Carolina, the surface of which is level to gently rolling. "The northern half of the county is higher and, in general, better drained than the southern part, where there are extensive areas of flat savannas and low-lying, poorly drained land. The bottom lands along the streams are wide and the streams sluggish. . . .

"The soils of Dorchester County are divided into three classes: (1) Upland or sedimentary soils, consisting of unconsolidated Coastal Plain sands and clays, derived originally from the Piedmont Plateau and the Appalachian Mountains, (2) terrace . . . soils lying above overflow, consisting of old alluvial material derived from the Coastal Plain soils, and (3) first-bottom . . . soils." Including tidal marsh, 27 soil types of 10 series are mapped, of which the Johnston loam, Norfolk sandy loam, and Norfolk fine sandy loam cover 15.4, 11.8, and 10.7 per cent of the area, respectively.

Soils of Grayson, Lee, McLennan, Titus, and Tyler counties [Texas], G. S. Fraps (*Texas Sta. Bul. 192 (1916), pp. 51*).—This bulletin contains a description of soil types in the counties named, based on surveys by the Bureau of Soils of the U. S. Department of Agriculture previously noted (E. S. R., 16, p. 1059; 19, p. 417; 26, p. 718), together with chemical analyses of representative samples and a discussion of their fertility requirements based in part on pot experiments.

The soils of Grayson County, covering 1,010 square miles consisting mainly of black prairie lands, were found to be well supplied with total phosphoric acid but low in available phosphoric acid. A number of the soils are low in nitrogen. It is concluded that these soils require legume rotation and the application of acid phosphate.

The soils of Lee County, covering about 700 square miles, were found to be for the most part deficient in active phosphoric acid and nitrogen. Nitrogen and acid phosphate applications and crop rotations are recommended for these soils.

The soils of McLennan County surveyed, covering 440 square miles, were found for the most part to be well supplied with phosphoric acid, nitrogen,

and potash, and fairly well supplied with lime. Crop rotation appeared to be the principal requirement of the soils.

The soils of Titus County, covering 426 square miles, were found to be relatively deficient in nitrogen and lime. The active and total phosphoric acid contents were low in some cases.

The soils of Tyler County surveyed, covering 100 square miles, were found to be acid and relatively deficient in nitrogen and potash and with one exception in phosphoric acid.

Soil survey of Smith County, Texas, L. R. Schoenmann, E. H. Smies, W. A. Rockie, E. T. Maxon, F. Z. Hutton, and H. G. Lewis (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 51, fig. 1, map 1*).—This survey, issued January 23, 1917, deals with the soils of an area of 570,880 acres in the Gulf Coastal Plain region in northeastern Texas, the topography of which is gently rolling to moderately hilly. "Only a small part of the county is too rough for cultivation, and a still smaller part is so smooth and level as to possess poor natural drainage."

The soils are grouped as upland and lowland soils. "More than 75 per cent of the upland consists of fine sands, fine sandy loams, and gravelly sandy loams, with subsoils ranging from fine sand through fine sandy clay to stiff, heavy clay. The clay soils are comparatively insignificant in extent, but the clay loams and gravelly clay loams are fairly extensive. The greater part of the first-bottom soils consists of clay and silty clay loam, but the fine sandy loams have an important distribution. The second-bottom, or terrace, soils are sandy and rather small in extent."

Including meadow, 22 soil types of 13 series are mapped, of which the Ruston fine sandy loam, the Susquehanna fine sandy loam, and the Norfolk sand cover 22.7, 21.9, and 18 per cent of the area, respectively.

Soil survey of Franklin County, Washington, C. Van Duyne, J. H. Agee, and F. W. Ashton (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 101, pls. 2, figs. 7, map 1*).—This survey, made in cooperation with the State of Washington and issued January 13, 1917, deals with the soils of an area of 786,560 acres in south-central Washington. The eastern part of the county is high rolling plateau and the western part undulating desert plain. "Over the greater part of the county there is no surface run-off, the water being removed by seepage and evaporation." The soils of the county are derived from a mantle of lake laid, wind laid, loessial, and current laid material. Including four types of miscellaneous character, 30 soil types of 12 series are mapped, of which the Ritzville silt loam, Ephrata very fine sandy loam, and scabland cover 31.3, 14.2, and 9.3 per cent of the area, respectively.

Calcium compounds in soils, E. C. Shorey, W. H. Fry, and W. Hazen (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 3, pp. 57–77*).—This report presents analytical data bearing on the kinds of calcium compounds in 63 samples of soil representing 23 types from 24 locations in 19 States. The quantities of calcium carbonate, calcium sulphate, calcium combined with humus compounds, and calcium present as easily and difficultly decomposable silicates are calculated.

The results show "a wide variation in total calcium content and in content of calcium carbonate and the two classes of silicates. Calcium combined with humus compounds is shown to be absent in 29 samples. No relation is apparent between the total calcium content and the quantity of any of the classes of calcium compounds discussed. It is shown that it is possible to have two soils with the same calcium content, but with the kinds of calcium compounds present in quite different quantities. But five of the samples, representing two types, were acid to litmus. These types are characterized by

poor drainage. A type represented in this series, recognized as a good alfalfa soil, is characterized by a high calcium content, but low in content of calcium carbonate."

Studies of the lime requirements of certain soils, L. J. Wild (*Trans. and Proc. New Zeal. Inst., 48 (1916), pp. 513–517*).—Tests of the Hutchinson and MacLennan method of determining the lime requirement of soil, which is based on the absorptive capacity of the soil for calcium carbonate presented to it in solution as bicarbonate (E. S. R., 33, p. 622), showed that the method gives results for a given soil which agree sufficiently with what is known from other sources of the lime requirements of that soil for practical purposes.

"It has been shown, however, that the result for any given soil varies with the strength of the solution and that in practice it is necessary to make the determination under standard conditions. Either a solution of uniform strength must be employed for all determinations or a correcting factor must be applied."

The phenomenon of absorption in its relation to soils, J. A. Prescott (*Jour. Agr. Sci. [England], 8 (1916), No. 1, pp. 111–130, fig. 1*).—This is a critical review of investigations on this subject, dealing with the general facts of absorption, Way's chemical hypothesis, Liebig's physical hypothesis, Knop's compromise and analytical method, absorption of acid radicals, effect of temperature on absorption, absorption by humus, the conception of colloids, adsorption, and adsorption isotherms. Particular attention is given to the applications of absorption phenomena to soils.

The definition of soil fertility by means of the analysis of plants, P. Savvin (Sawine) (*Zhur. Opytn. Agron. (Jour. Agr. Expt.), 17 (1916), No. 1, pp. 1–12; abs. in Chem. Abs., 10 (1916), No. 22, pp. 2950, 2951*).—Experiments are reported, the results of which are taken to indicate the following:

Oat grains contain phosphoric acid almost exclusively in organic combinations. Phosphates are generally in the straw. The percentage of organic phosphoric acid in an entire plant varies between very narrow limits, which experimentally were found to be from 0.41 to 0.6 per cent. The size of harvest does not influence this, and the amount of phosphoric acid which has entered the plant influences it only to a small degree. If phosphoric acid is abundant in the nutritive solution it enters into the plant in greater quantity, but it is only an insignificant part which takes an organic form, the greater part entering the straw as phosphates. The quantity of phosphates in the straw varies according to the conditions of a given vegetative period. It is concluded that for this reason the conditions relating to phosphoric acid can not be used for indicating soil fertility. The total phosphoric acid in the straw and in the entire harvest can, however, indicate the need for phosphatic fertilization.

Certain biological chemical processes in relation to the humification of plant residues, A. Trusov (Troussoff) (*Zhur. Opytn. Agron. (Jour. Agr. Expt.), 17 (1916), No. 2, pp. 165–179, figs. 8*).—The various processes and products involved in humification and the complex mixture known as humic acid are discussed.

Studies on soil protozoa and their relation to the bacterial flora, I, II, J. M. Sherman (*Jour. Bact., 1 (1916), Nos. 1, pp. 35–66; 2, pp. 165–185*).—Studies conducted at the Wisconsin Experiment Station on the life and activities of soil protozoa, with special reference to their influence on the numbers of soil bacteria, are reported.

In the soil studied the flagellates were the predominating type of protozoa. *Colpoda cucullus* appeared to be the most widely distributed ciliate. It was found that the ciliates *C. cucullus*, *Balantiophorus elongatus*, and *Oxytricha* sp. are not active under ordinary soil conditions. The bacterial flora in soils containing protozoa and free of protozoa behaved in exactly the same way when

exposed to different conditions of temperature and moisture content. The ciliates *C. cucullus* and *B. elongatus* in pure culture were detrimental to bacteria in solutions but not in soil. Four types of active soil flagellates were not capable of limiting the number of bacteria when acting in soil, but one culture was injurious to bacteria in soil extract.

Treatment of soil with the ordinary amounts of volatile antiseptics (1 to 2 per cent) did not appear to simplify the protozoan fauna, and as much as 10 per cent of carbon bisulphid or toluene failed to exterminate the protozoa entirely. Within one month after treatment normal numbers of protozoa were again present in the soil. The maximum number of bacteria in partially sterilized soil was not found while the protozoa were suppressed but after they had again returned to their normal level. It appeared that the development of these two classes of micro-organisms subsequent to treatment with volatile antiseptics ran parallel. The reinoculation of partially sterilized soils with 1 per cent of normal soil failed to decrease the number of bacteria.

"The results of the foregoing experiments appears to establish quite definitely that protozoa in the soils which have been studied do not have a detrimental effect upon the bacterial flora."

A list of 70 references to literature bearing on the subject is appended.

The disinfection of soil, É. Miège (*Assoc. Franç. Avanc. Sci., Comptt. Rend., 43 (1914), pp. 978–982*).—This is a summary of the results of the work of others bearing on the subject.

Rotation and manure experiments on the Wisconsin drift soil area, W. H. Stevenson and P. E. Brown (*Iowa Sta. Bul. 167 (1916), pp. 462–476, figs. 8*).—Six-year rotation and manuring experiments on Carrington loam soil are reported. The rotation experiments were carried out on 13 1/10-acre plats and the rotations were as follows: Continuous corn; 2-year rotation, corn and oats; 3-year rotation, corn, oats, and clover; 2-year rotation, corn and oats, clover turned under; 2-year rotation, corn and oats, cowpeas turned under; 2-year rotation, corn and oats, rye turned under; and continuous clover. The manuring experiments were conducted on 20 1/10-acre plats and the manure used at rates of 8, 12, 16, and 20 tons per acre.

It was found that the continuous growing of crops on this soil decreases its fertility and leads to rapidly declining crop yields, while the rotation of crops gives greater profit than the continued growth of corn. "A 3-year rotation of corn, oats, and clover is more profitable than a 2-year rotation of corn and oats, or a 2-year rotation with clover, cowpeas, or rye used as a green manure crop. The introduction of clover, cowpeas, and rye into a 2-year rotation increases the crop yields, but it can hardly be considered profitable except in the case of the clover. The profit is less, however, in every case than in the 3-year rotation.

"The best amount of manure to apply to this type of soil appears to be between 8 and 16 tons per acre, applied once in a 4-year rotation. Applications of more than 16 tons of manure per acre are not profitable. Manure applied in three equal amounts in the first, second, and fourth years of the 4-year rotation proved of greater value on this soil than the same total amount applied once in the rotation. Manure should not be applied to this soil after the corn crop is up, as very much smaller effects are secured from its use than when it is plowed under or disked in after plowing. On this soil type the latter method seems to be slightly preferable."

A modified method of green manuring, C. M. Hutchinson (*Agr. Research Inst. Pusa Bul. 63 (1916), pp. 12*).—Field experiments are reported which confirm the conclusions from results of laboratory tests given in a previous bulle-

tin (E. S. R., 31, p. 722) "that green crops instead of being plowed or buried by other methods directly in the soil on which they had been grown, should first be treated in such a way as to bring them into a more suitable condition for use as manure." Tests were made of methods of doing this with sann hemp as follows: "(1) Aerobic, in which the green manure was fermented in heaps, kept moist but not covered with clay, [and] (2) anaerobic, in which the heaps were plastered with clay. The sann hemp was first cut into short lengths and soaked in water in a pit for 24 hours. It was then removed from the pit and transferred to another shallow one, in this case about 1 ft. deep and 8 ft. square."

In aerobic fermentation "the soaked material was arranged in alternate layers of sann and soil, the former about 3 in. and the latter about 0.5 in. in thickness. The whole heap was then covered with a layer of soil about 3 in. thick and finally with one of straw to prevent evaporation. Watering was carried out about once a week, sufficient water being added to keep the top layer moist. [In] anaerobic fermentation the heaps were arranged in the same way, but each layer was consolidated by treading down, and the whole heap was finally plastered with clay about 1 in. thick." After 48 days the heaps were broken down and the material applied to experimental plats of tobacco either in furrows or ridges. The results indicated a decided superiority of the aerobically fermented manure applied in the furrows.

"With regard to the difference in character of the anaerobic and aerobic preparations, it was found that when first taken from the heap the former contained no nitrate but a considerable amount of ammonia (recoverable by distillation with magnesia although not free). A water extract of the material was toxic to seedlings, but this condition was changed and nitrate formation took place after aerobic conditions were introduced, more complete nitrification of the organic nitrogen present being eventually obtained than was the case with the aerobically prepared material. This was in accordance with the laboratory observations of the previous year, and confirms the conclusion as to the possibility of preparing a more rapid acting manure by this method, keeping in view, however, the necessity for interposing an aerobic stage between the anaerobic preliminary one and the final application to the soil, not only to promote nitrification, but to insure the oxidation and destruction of the toxins produced."

A note by S. Milligan especially on the economic feasibility of the proposed method is included.

Peat in 1915, J. S. Turp (*U. S. Geol. Survey, Mineral Resources of the United States Calendar Year 1915, pt. 2, pp. 1027–1030*).—This report deals with the production and use of peat in the United States during 1915.

"The production of peat for fertilizer and fertilizer filler during 1915 was 38,304 short tons, valued at $258,447, as compared with 37,729 short tons, valued at $249,899, in 1914. . . . The lowest price per ton reported was $3, the highest $16 and the average $6.75." The entire importation of peat litter in 1915 was 7,514 short tons, valued at $48,142.

Some sources of potassium, C. T. Hirst and E. G. Carter (*Utah Sta. Circ. 22 (1916), pp. 3–12*).—This circular deals briefly with the function of potash in plant nutrition, the German potash deposits, and the consumption of potash in the United States, but discusses more particularly the actual and possible sources of potash in the United States, including especially alunite, leucite, material from nitrate deposits near Rigby, Idaho, material from the bed of an old alkali lake, and the ash of various desert plants. Analyses of the material from the nitrate deposit, the lake bed, and of the ash of the desert plants are

reported. The amounts of potash in the dry plant were found to be as follows: Sage brush 0.43 per cent, white sage 1.64, rabbit brush 0.75, Brigham tea 0.35, and greasewood 0.96.

Potash as a by-product from the blast furnace, R. J. WYSOR (*Bul. Amer. Inst. Mining Engin., No. 121* (*1917*), *pp. 1–32, figs. 20*).—Data showing the amount of alkalis, especially potash, occurring in the raw materials and in the slag, cinder, dust, fumes, etc., of the blast furnaces of a large steel works are reported and discussed with reference to the feasibility of recovering the potash for sale.

It is stated that with the gas-cleaning methods now used in the blast furnaces there is a loss in the primary washers alone of over one-half of the total potash charged, or from 9 to 12 lbs. per ton of pig iron produced. The amount recovered by these methods is less than 2 per cent of the total. About two-thirds of the total potash charged is now lost in the wash water and stack gases, or about 15 lbs. per ton of pig iron produced. Experiments with an electric dust precipitator showed that practically all the dust and fume entering the treater can be successfully precipitated by this means. The precipitated dust was found to contain about 10 per cent of potash. It is suggested that while weak acid treatment may be effective in making the potash of the flue dust soluble it is not likely to be practicable, but that the soluble alkali salts can be recovered in tolerably pure form by leaching and evaporation.

The author is of the opinion " that in the future dry cleaning will be adopted in many blast furnace plants, and that many thousands of tons of potash hitherto wasted will be reclaimed."

A bibliography of the more important articles bearing on the subject is appended.

Potash becomes a valuable cement mill by-product, A. C. HEWITT (*Engin. News, 76* (*1916*), *No. 26, pp. 1222–1226, figs. 5*).—This is a description of a dust precipitation plant of a cement mill at Hagerstown, Md., which not only reduces the dust nuisance, but is said to be profitable for its production of potash. At the present time, with two kilns 7 by 100 ft. and three kilns 8 by 125 ft., the production of potash dust is said to average from 20 to 25 tons per 24 hours, containing approximately 10 to 20 per cent of potassium sulphate.

The effect of additions on the availability of soil potash, and the preparation of sugar humus, G. S. FRAPS (*Texas Sta. Bul. 190* (*1916*), *pp. 30*).—Four series of experiments are reported on the effect of additions of calcium carbonate, sawdust, sugar humus, corncobs, calcium sulphate, sodium sulphate, sheep manure, and magnesium carbonate on the quantity of potash taken up by crops of corn, cotton, sorghum, and oats from eleven soils, including Norfolk sand, bottom land soil, sand, Norfolk fine sand subsoil, brown mesquite soil, white sand, very poor upland soil, moderate upland soil, poor upland subsoil, poor upland soil, and Norfolk white sandy loam subsoil.

It was found that gains of potash due to the addition of calcium carbonate or organic matter were comparatively small. The active potash of the soil needed no addition of calcium carbonate, as it was already highly available. Sodium sulphate and gypsum were often injurious. Plants were found to take up an excess of potash over their actual needs. The percentage of potash in the plants decreased as the amount of active potash in the soil decreased. Additions of calcium carbonate did not increase the quantity of active potash remaining in the soil at the end of the experiments.

" The quantity of active potash lost is from 60 to 90 per cent of that taken up by the crop, until the active potash is reduced so that the potash removed actually comes from insoluble potash compounds and not from the active potash. Active potash may be readily and rapidly removed by crops down to the quan-

tity representing the potash from highly insoluble compounds. Additions of sulphate of lime, nitrate of soda, or other salts have no such effect upon rendering potash available to plants as has been claimed. They would have only a slight effect."

A study of conditions affecting the yield of sugar humus is also reported and a method of preparing it described.

Solubility of mineral phosphates, A. AITA (*Ann. Chim. Appl. [Rome], 6 (1916), No. 1–2, pp. 28–44, fig. 1; abs. in Chem. Abs., 10 (1916), No. 22, pp. 2953, 2954*).—Consecutive extractions with 2 per cent citric acid made on different types of phosphates showed that nodulous and hard phosphates gave up their phosphoric acid more slowly than the more friable varieties, seven or eight extractions being required for the former.

With reference to the influence of the calcium oxid content, it was found that in the first extraction the percentage of phosphoric acid extracted increased as the calcium oxid content decreased. In the successive extractions the percentage of phosphoric acid extracted continually increased in the case of high calcium oxid content, with the order of the extraction as the calcium oxid disappeared under the action of the citric acid. With phosphate of low calcium oxid content the opposite occurred in subsequent extractions. Ignited phosphates gave up their phosphoric acid more slowly than the natural minerals.

In studies of the solubility of mineral phosphates in 2 per cent citric acid in the presence of salts, two consecutive extractions were made. It was found that (1) calcium salts diminished the solubility, (2) ammonium, alkali, and magnesium salts brought about an increase of solubility proportionate to their concentration and dependent on the factors of friability, fineness, and calcium oxid content, and (3) the increase of solubility was a function of the anion. The author attempts to explain these results, and draws the conclusion that finely ground mineral phosphates may be used in agricultural practice as substitutes for basic phosphates if they are accompanied either at the time of spreading over the soil or during growth of the vegetation by fertilizers of ammonium, potassium, or soluble magnesium salts.

The utilization of phosphates by agricultural crops, including a new theory regarding the feeding power of plants, E. TRUOG (*Wisconsin Sta. Research Bul. 41 (1916), pp. 50, figs. 14*).—Supplementing experiments previously reported (E. S. R., 27, p. 127), pot culture experiments were made with corn, oats, barley, millet, turnips, rape, buckwheat, clover, alfalfa, serradella, sunflowers, and tobacco to test the availability of acid phosphate, rock phosphate, ferrous phosphate, ferric phosphate, tricalcium phosphate, aluminum phosphate, manganous phosphate, and trimagnesium phosphate. In the case of corn the effect of different nitrogenous compounds, namely, calcium, ammonium, sodium, and potassium nitrates, was also tested. The degree of utilization of the phosphates was measured both by the yield and the phosphorus content of the crops grown.

It was found that "the different species of plants showed some marked individual preferences for the different phosphates. Solubility of the phosphates was not the only factor that determined the growth of a plant on these phosphates. Precipitated ferric and aluminum phosphates produced with a few exceptions good growths and in a few cases even better growths than the acid phosphate. The availability of these phosphates is undoubtedly due to ease of hydrolysis of the neutral or nearly neutral material, in which case the phosphoric acid goes into solution and there is left a basic phosphate. . . . The phosphorus of precipitated tricalcium phosphate was much more available than that of rock phosphate, although the form of phosphate is perhaps nearly the same in the two." The author attributes this to the greater ease of

hydrolysis of the freshly precipitated form of phosphate, due partly to the better physical condition.

Great differences in the feeding powers of the different plants were observed. It was found, as is shown in a previously noted article (E. S. R., 33, p. 519), that plants containing a relatively high calcium oxid content showed a relatively high feeding power for the phosphorus in raw rock phosphate, while for plants containing a relatively low calcium oxid content the reverse was true. The theory advanced to explain the variation in the feeding power of plants for difficultly soluble phosphates (and other substances) is summarized as follows:

"Each point of contact or near contact between the absorbing surface of root hairs and difficultly soluble substances may be regarded as a chemical system which strives to attain a point of equilibrium between liquid and solid phases. In this system carbonic acid and water are the main agents causing solution. In some cases the action is largely one of hydrolysis and there is formed a soluble product and an insoluble product, e. g., action of water on ferric phosphate; in other cases the action may be both by hydrolysis and carbonation and the products formed are both soluble, e. g., action of carbonated water on calcium phosphate; or only one of the products may again be soluble, e. g., action of carbonated water on feldspar.

"In order that the solubility reaction may continue in any of the cases, it is necessary that proportionate amounts of all the soluble products be continually removed. Thus, if a plant is to feed strongly on rock phosphate, both the calcium acid phosphate and calcium bicarbonate must be used by the plant in somewhat proportionate amounts. In this case the calcium oxid content of the plant becomes the determining factor in the feeding power."

"The increased availability of rock phosphate when used in connection with ammonium salts is explained by this theory as due at least partly to the increased solubility of the calcium carbonate and bicarbonate in solutions of ammonium salts. The greater availability of rock phosphate in acid soils than in nonacid soils, especially to plants with weak feeding powers, is also explained, since acid soils will remove the calcium carbonate and bicarbonate from solution and thus make it possible for the solubility reaction to continue."

It is pointed out that since the roots of plants at any one time come in contact with only a small portion of the internal surface of the soil, and the feeding of plant roots therefore probably takes place largely in local soil areas, the rate at which phosphorus goes into solution in the local areas in contact with the roots is a more important consideration than the amount of it which may be drawn off from the whole soil mass in one extraction.

It was observed in these experiments that plants grown with magnesium phosphate had an exceptionally high content of phosphorus, thus supporting Loew's hypothesis (E. S. R., 15, p. 227) that magnesium functions as a conveyor of phosphorus in the plant. A high calcium oxid content was found in certain cases to be associated with a high protein content, thus indicating an important function of calcium in protein synthesis. Plants grown with manganous phosphate were found to contain considerable amounts of manganese, and since manganese affects the chlorophyll formation of certain plants, especially of clover and alfalfa, it is suggested that the poor growth of these plants on certain acid soils may be due to the presence of considerable amounts of manganese.

Report on commercial fertilizers, 1916, E. H. Jenkins and J. P. Street (*Connecticut State Sta. Rpt. 1916, pt. 1, pp. 1–63*).—This bulletin contains the results of actual and guarantied analyses of 828 samples of fertilizers and fer-

tilizing materials offered for sale in Connecticut in 1916, together with analyses of 10 samples of tobacco soils, made with the object of studying the cause of the unsatisfactory yield of tobacco from certain soils.

Tabulated analyses of commercial fertilizers, W. Frear et al. (*Penn. Dept. Agr. Bul. 282* (*1916*), *p. 75*).—This report contains the results of actual and guarantied analyses and valuations of 816 samples of fertilizers and fertilizing materials collected for inspection in Pennsylvania from January 1 to August 1, 1916.

Commercial fertilizers in 1915–16, G. S. Fraps (*Texas Sta. Bul. 193* (*1916*), *pp. 3–23*).—This bulletin reports the results of actual and guarantied analyses of 291 samples of fertilizers and fertilizing materials collected for inspection in Texas during 1915–16. A list of brands registered for sale in the State is also included. Attention is called to the fact that Texas soils are as a rule well supplied with potash, and that potash can therefore be eliminated from general fertilizers, especially for cotton and corn.

AGRICULTURAL BOTANY.

Plants in health and disease, F. E. Weiss, A. D. Imms, and W. Robinson (*Manchester: University Press; London and New York: Longmans, Green and Co., 1916, pp. VIII+143; rev. in Roy. Bot. Gard. Kew, Bul. Misc. Inform., No. 4* (*1916*), *p. 112*).—This is a reprint in book form of lectures delivered at the University of Manchester during the session 1915–16 on plant life, animals injurious or beneficial thereto, and the nature, progress, and control of plant diseases, more particularly as relating to conditions prevalent in Manchester, England, during the present period with its unusual needs. The scientific information embodied is presented in popular form for purposes directly practical, and a few references are given to related literature, mostly on the zoological side.

The raw materials of the plant kingdom, J. von Wiesner (*Die Rohstoffe des Pflanzenreiches. Leipsic and Berlin: W. Engelmann, 1914, 3. ed., rev. and enl., vol. 1, pp. X+759, figs. 98*).—This is the first of the three volumes of which this third edition (E. S. R., 12, p. 996), when completed, is to be composed. The 10 sections of this volume deal, respectively, with gums, resins, caoutchouc, opium, aloes, camphor, indigo, catechu, vegetable fats, and vegetable wax, concluding with a detailed alphabetical list of the various substances included under the above heads.

Physiological characters of plants.—II, Oils and alkaloids of Papaveraceæ; III, Oils and alkaloids of Ranunculaceæ and Berberidaceæ, S. L. Ivanov (*Soobshch. Bíūro Chastn. Rast.* [*Petrograd*], *2* (*1915*), *No. 7, pp. 25–38*).—Incompleted studies have shown that the presence of various oils and alkaloids is not confined to *Papaver somniferum*, but that oils of certain Ranunculaceæ may prove to be of great commercial value, particularly on account of their high melting point.

The overlapping of the leaf sheath and its lack of value for descriptive botanical literature, A. B. Conner and R. E. Karper (*Science, n. ser., 45* (*1917*), *No. 1154, pp. 144, 145*).—From a study of milo maize and Kafir corn grown under different environmental conditions, the authors have found that internodal length varies widely and that there is little variation in the length of the leaf sheath. On this account, it is claimed that the overlapping of the leaf sheath can not be considered a character of value in descriptive botany.

A contribution to the problem of homotyposis, J. A. Harris (*Biometrika, 11* (*1916*), *No. 3, pp. 201–214, figs. 4*).—The data on *Cercis canadensis* presented in this paper are drawn from records of work begun in 1905 and already con-

sidered more comprehensively in dealing with problems distinct from the one here discussed (E. S. R., 31, p. 523). The results as tabulated are discussed in connection with some obtained by other investigators.

It is stated that the average homotypic value for ovules in Cercis is distinctly higher than the comparable values for other species hitherto adequately investigated, the mean values for seeds being about the same as those found by English investigators. The correlation of ovules failing is lower. The homotypic correlation for seeds matured per pod is statistically largely a resultant of the homotypic correlation for ovules and the organic correlation for ovules and seeds of the same pod. There are supposed to be independent ecological and physiological factors tending to differentiate individuals with respect to capacity for seed production. The general rule for fertility characters in Leguminosæ apparently is that the maximum value of the homotypic correlation is the same as that for number of ovules per pod, much lower values being found for matured seeds or abortive ovules per pod. The author believes that the evidence also points in the direction of a lower correlation for ovules than for the more truly vegetative characters of the plant.

Inheritance in crosses between Nicotiana langsdorffii and N. alata, E. M. East (*Genetics, 1 (1916), No. 4, pp. 311–333, figs. 10*).—Reporting on a study of a fertile cross between *N. langsdorffii* and *N. alata grandiflora*, each uniform in its characters, the results being the same without regard to the direction in which the cross was made, the author states that while the F_1 populations are as uniform as the parents, the F_2 are nearly three times as variable as the F_1 plants. Individuals reproducing *N. langsdorffii* were found in the F_2 generation, certain of these F_2 individuals reproducing their own form in the F_3 generation. No F_2 individuals reproducing *N. alata grandiflora* were found, but F_2 plants approaching this type were produced. Galtonian regression occurred, but selected extremes regressed no more than those deviating moderately from the parental mean. Individuals from the same point on the F_2 curve showed different variabilities in the F_3 generation, such variations being always smaller than those of the F_2 families.

The above conclusions, based upon corolla measurements, appear to be true also for other characters, except that in respect of such other characters, *N. alata grandiflora* types were reproduced. Corolla color and pollen color are said to show Mendelian inheritance, and this is considered to be the only logical interpretation of the other phenomena.

Linkage in Primula sinensis, E. Altenburg (*Genetics, 1 (1916), No. 4, pp. 354–366*).—The author claims to have found that crossovers between the pairs of linked factors long or short style and red or magenta flower, respectively, take place without reference to the crossovers between the pairs of linked factors red or magenta flower color and red stigma or green stigma, respectively; that is, there is no interference. Single anthers and single ovaries of the heterozygous individuals produce all classes of gametes. Reduction of factors must therefore accompany cell divisions occurring within many or all the anthers and ovaries. The proportions of the various gametic classes of linked factors are about the same for the anthers and the ovaries.

Some correlations in sugar beets, F. S. Harris and J. C. Hogenson (*Genetics, 1 (1916), No. 4, pp. 334–347*).—This is a study of correlations in sugar beets between the several characters in order, if possible, to obtain short cuts in the process of improvement of desirable qualities. The tables given show correlations which, omitting decimal variations, may be expressed as follows: Weight of beet with percentage of sugar, −0.2878; percentage of sugar in the mother beet with quantity of seed produced, 0.0049; height of plants with weight of seed produced, 0.3985; weight of the mother plant with quantity of seed

produced, 0.3075; number of stems on each plant with the quantity of seed produced, 0.2771; number of days to mature with quantity of seed produced, 0.1954; number of leaves on each stalk with quantity of seed produced, 0.1217; days to mature with height of plant, 0.1748; percentage of sucrose in the mother beet with days to mature seed, —0.1292; and percentage of sucrose in the mother beet with number of leaves on each stalk, 0.2484.

What is happening to the hawthorns? L. M. STANDISH (*Jour. Heredity, 7 (1916), No. 6, pp. 266–279, figs. 11*).—Summarizing the results obtained from a study of Cratægus and from a review of contributions thereon, the author notes the facts that among the members of this genus a remarkable amount of comparatively recent multiplication of forms has become evident in the descriptive literature and that the presence of large numbers of local species in a given area is correlated with unusual sterility. Out of 171 specimens examined, only 35 could be regarded as being uncontaminated with regard to pollen conditions, while 76 showed from 50 to 100 per cent abortive grains. A study of other groups available is said to show parallel conditions, the pollen being usually good in the more widely distributed species but largely abortive in those of restricted areas.

The study of the genus Cratægus is said to give evidence of both systematic and morphological character which is considered to indicate the widespread occurrence of hybridism. The author concludes that among the members of this genus, at least, extreme variability is linked with extensive hybridism and the consequent multiplication of species rather than with mutation and the problem of the saltatory origin of species.

Influence of the composition and concentration of the nutrient solution on plants grown in sand cultures, A. H. AYRES (*Univ. Cal. Pubs. Agr. Sci., 1 (1917), No. 11, pp. 341–394, pls. 11, figs. 10*).—The results are given of a series of tests with a hybrid species of Nicotiana, the plants being grown in washed sand and supplied with nutrient solutions containing sodium nitrate, calcium phosphate, potassium sulphate, and magnesium sulphate. The salts were so used as to give information regarding the separate compounds, the total concentration of salts, and the balance of salts in the solution, the height, leaf length, leaf width, flower production, and dry weight of tops being taken as indications of the influence of the solution on the growth of the plant.

Nitrogen was found a more important growth-limiting factor than phosphorus, while phosphorus, in turn, was more important than potassium. Plants grown in solutions of low concentration were in general superior to those grown in solutions of higher concentration. The author claims that the physiological balance of salts in the solution is an important factor which must be taken into consideration in connection with the composition and concentration of the solution, as growth is influenced by a combination of all these factors. The concentration of the nutrient solution was found to affect the economical use of nitrogen. Less calcium was absorbed from solutions at low concentrations than from those that had a high total concentration, but it seems to be used with greater economy in low concentrations than in high ones.

A comparative study of nutritive solutions in sand and water cultures, A. A. STOL'GANE (STOLHANE) (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), Moskov. Selsk. Khoz. Inst., 10 (1914), pp. 289–336*).—Experiments are reported in which a test was made of the comparative value of nutritive solutions prepared according to the formulas of Hellriegel, Crone, and Prianishnikov. From a study of barley and flax, the growth of plants and the absorption of nitrogen, phosphoric acid, sulphur, potash, and calcium was determined for the different solutions. Analyses are given of different parts of plants in the various cultures, from which it appears that the different

nutrient solutions produced varying results for the different species grown in both sand and water cultures. The rapidity of the absorption of the different compounds varied with the different plants, and an excess in the solution of any given material was not shown in its increased accumulation in the plants. The quantities of the various elements absorbed and assimilated were not always the same.

The effect of repeated growing of plants in nutritive solutions, E. A. ZHEMCHUZHNIKOV (GEMTCHOUGENIKOV) (*Iz Rezul't. Veget. Opytov Lab. Rabot* (*Rec. Trav. Lab. Agron.*), *Moskov. Selsk. Khoz. Inst., 10* (*1914*), *pp. 327–354, pl. 1, figs. 3*).—Experiments are reported with a number of species of plants reseeded in sand cultures in which the same species had been previously grown.

The results showed that the growth was inversely proportional to the alkalinity of the solutions resulting from growing the previous crops. Where the nutrient solutions contained nitrates such as are recommended by Hellriegel, Knop, Crone, and others, the alkalinity was more pronounced and the growth more rapidly diminished than where ammonium nitrate was employed as a source of nitrogen.

The influence of the alkalinity of a solution on the transformation of nitrogenous material in germinating peas, V. A. MOROZOV (MOROSOV) (*Iz Rezul't. Veget. Opytov Lab. Rabot* (*Rec. Trav. Lab. Agron.*), *Moskov. Selsk. Khoz. Inst., 10* (*1914*), *pp. 384–389, fig. 1*).—The author claims that the alkalinity of the nutrient solution retards the transformation of nitrogenous materials contained in seeds without changing the process.

The significance of the potassium ion in the synthesis of nitrogen compounds in the plant cell, J. STOKLASA (*Biochem. Ztschr., 73* (*1916*), *No. 1–2, pp. 107–160*).—In continuance of previous work (E. S. R., 25, p. 125), the author has studied the rôle of potassium ions in the synthesis of nitrogen compounds, employing the sugar beet as well as bacterial cultures for this purpose.

It is thought that the potassium ion is concerned in the formation of nitrogenous materials in the bacterial cell, probably being connected with condensation and catalytic processes. In case of beets kept under illumination in an atmosphere free from carbon dioxid and supplied with carbon in the form of glucose, fructose, or saccharose, nitrogen compounds are formed by them both in the presence and in the absence of potassium ions. When the supply of plastic organic compounds in the cell is abundant, and there is solar illumination, nitrogen compounds may form without the presence of potassium, and they may form without sunlight in the presence of abundant potassium, carbon sources, and inorganic nutrients in the cell. Without potassium and in darkness, nitrogen compounds are not synthesized, even when the carbohydrates are abundant in available form. On complete exclusion of light, the potassium ion appears to serve as a source of energy and to condition the formation of carbohydrates through the action of respiratory enzyms. The processes of formation of new living cells and of dissimilation appear to be related in some way. Potassium is thought to play an important part in dissimilation and in physiological combustion and, in connection with light, to bring about catalytic reactions and photodynamic effects.

The rôle of calcium carbonate in the assimilation of ammonia, V. A. MOROZOV (MOROSOV) (*Iz Rezul't. Veget. Opytov Lab. Rabot* (*Rec. Trav. Lab. Agron.*), *Moskov. Selsk. Khoz. Inst., 10* (*1914*), *pp. 390–395*).—The author has studied the effect of replacing calcium carbonate by ferric hydroxid. He has found that if the etiolated plants received ammonium sulphate as a source of nitrogen, the results were favorable to the addition of ferric hydroxid, but the action of calcium carbonate was more energetic.

The rôle of ammonia in the transformation of nitrogenous material in plants, D. N. PRIANISHNIKOV (PRIANICHNIKOV) (*Iz Rezul't. Veget. Opytov. Lab. Rabot (Rec. Trav. Lab. Agron.), Moskov. Selsk. Khoz. Inst., 10 (1914), Sup. 3, pp. 24*).—According to the author, plants may be divided into three groups, depending upon their utilization of ammonia. The first group, which is typified by maize, barley, pumpkin, etc., is readily supported by weak solutions of ammonium chlorid or ammonium sulphate, from which ammonia is readily absorbed and asparagin or glutenin formed.

The second group of plants absorbs ammonia feebly or not at all. However, on the addition of calcium carbonate, they take up ammonia rapidly and form asparagin. Peas and vetches are given as typical of this group.

In the last group, which is represented by *Lupinus luteus*, the introduction of ammoniacal salts into the solutions produces a profound change with the production of ammonia arising from the nitrogenous materials in the seeds. The addition of calcium carbonate does not reestablish the normal course of nitrogen transformation. The author attempts to explain, from his own or others' experiments, this unusual behavior of the lupine toward ammonium salts.

The formation of asparagin by Lupinus luteus, A. G. NIKOLAEVA (NICOLAEVA) (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), Moskov. Selsk. Khoz. Inst., 10 (1914), pp. 380–383*).—Experiments are described which showed that etiolated plants of *L. luteus* behaved quite differently when ammonium nitrate, ammonium phosphate, and urea were present in the solutions from these plants when physiologically acid salts such as ammonium chlorid and ammonium sulphate were present. In the first case, there was an active formation of asparagin in proportion to the amount of ammonia absorbed, while in the second case ammonia accumulated in the plants without giving rise to the production of asparagin. Under the latter conditions, the phenomena of ammonia poisoning of plants were apparent.

The fixation of free nitrogen by certain fungi, C. O. CHAMBERS (*Plant World, 19 (1916), No. 7, pp. 175–194, fig. 1*).—Reporting studies by means of what is designated as the Folin method with *Aspergillus niger* and *Penicillium glaucum*, the author states that these fungi did not apparently make use of free nitrogen. This method is said to be very well adapted to work with very small quantities of material and to the determination of very small amounts of nitrogen.

A new case of symbiosis between a bacillus and a plant, P. GEORGEVITCH (*Roy. Bot. Gard. Kiev. Bul. Misc. Inform., No. 4 (1916), pp. 105, 106, figs. 21*).—In a preliminary note is described a case of symbiosis between a bacillus and *Kraussia floribunda* cultivated in the Kew Gardens. A description is given of the development, including spore formation, when transferred from nodules to potato or potato agar.

The assimilation of carbon dioxid, R. WILLSTÄTTER and A. STOLL (*Ber. Deut. Chem. Gesell., 48 (1915), No. 13, pp. 1540–1564; abs. in Jour. Chem. Soc. [London], 110 (1916), No. 639, I, pp. 105, 106*).—In a preliminary study of carbon dioxid assimilation, the authors found that the relation of chlorophyll content to assimilatory activity is variable. The most marked cases in this respect are those of leaves which are green in autumn, in which the assimilatory rate is relatively low, those of yellow varieties poor in chlorophyll, and those recovering color after etiolation and possessing a high assimilatory capacity.

A diminution in assimilatory activity as compared with chlorophyll content is observable during spring growth, and a comparable difference exists between young and old leaves. These differences are ascribed to a factor supposedly enzymatic in character. Leaves rich in chlorophyll show an assimilatory rate almost independent of the degree of illumination, the influence of the chlorophyll

factor then overcoming that of the enzym. Rise of temperature increases markedly the rate of assimilation in such leaves, while in leaves poor in chlorophyll that process is but little increased between 15 and 30° C., the enzym supposedly exerting its full effect in that case. The enzym, it is thought, may facilitate the decomposition of an intermediate compound of chlorophyll and carbon dioxid with liberation of oxygen.

Studies on the chemical transformations in the leaf of Diospyros kaki during the vegetative period and on its autumnal coloration, A. Parrozzani (*Ann. R. Staz. Sper. Agrum. e Frutticol. Acireale, 3 (1915), pp. 43–90*).—Concluding this partial report of a study of *D. kaki* as herein detailed, the author states that the facts as noted do not corroborate the view of a return of certain substances to the trunk before the fall of the leaves, but rather favor the view that the diminution of certain substances in the leaf at that time is caused by the action of water on the leaf and that the diminution of such substances as hydrocarbons may be attributed to oxidation. The autumnal red in leaves is thought to be due to the formation of a substance of glucosid nature which is altered in consequence of hydrolysis following oxidation.

On the assimilation of iron by plants, M. I. Sidorin (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), Moskov. Selsk. Khoz. Inst., 10 (1914), pp. 241–257, pl. 1, figs. 5*).—Investigations carried on in sand and water cultures in 1914, but not published until 1916, are held to show that the occurrence of chlorosis in plants grown in nutrient solutions with an excess of carbonates, especially calcium carbonate, depends on the alkalinity of the solution.

Alkalinity of itself is not the cause of chlorosis, but it is due to inaccessibility or lack of assimilation of iron under alkaline conditions. The same results may occur in nutrient solutions under conditions of physiological alkalinity. The ability of iron to form nearly insoluble compounds with phosphoric acid is often the cause of the poor assimilation of iron. The lack of chlorophyll in plants that have been grown without injury is partly analogous to chlorosis due to the lack of iron. It is claimed that iron has the property of being strictly localized in plant tissues, and this was conclusively shown in experiments with maize, in which the roots of plants were divided and grown in different solutions, one containing, the other lacking, iron.

Changes in the specific gravity of starches and dry substance of potatoes during the resting period, L. Széll (*Kisérlet. Közlem., 18 (1915), No. 5–6, pp. 1020–1029*).—A study was made of two potato varieties kept in the cellar and also in heaps in the open air. It was found that the specific gravity of starches and dry substance increased in the potatoes kept in the cellar but not in those kept in the open. The conclusion is reached that it pays to winter potatoes in good, airy cellars.

Changes in the chemical composition of rye under the influence of species of Fusarium, A. Pomaskiĭ (*Soobshch. Bûro Chastn. Rast., [Petrograd], 3 (1916), No. 1, pp. 32*).—Analyses and experiments made with *F. roseum* and *F. subulatum* showed that their presence on rye caused a decrease in dry substance, chiefly starch and proteids, the percentage of which fell in ten days to 67.3 per cent and in two months to 25.1 per cent. The amount of starch decomposed in one month was from 61 to 80 per cent, in two months, 86.5 to 89.5 per cent. The total quantity of nitrogen in cultures of *F. roseum* decreased about 5 per cent in the first ten days, and in a month the amount of nitrogen in a culture of *F. subulatum* had diminished by 2.7 per cent. The decrease of nitrogen with both species amounted to from 12 to 16 per cent in two months. Both species of Fusarium were found to be able to decompose starch and protein. The products of the decomposition of protein were albu-

mose, peptones, amino acids, organic bases, ammonia, and a toxin, probably a nitrogenous glucosid. Other changes were noted in pentosans, sugars, cellulose, and fat.

FIELD CROPS.

Yields of spring grains in Illinois, W. L. Burlison and O. M. Allyn (*Illinois Sta. Bul. 195* (*1917*), *pp. 499–508*).—This bulletin reports variety tests with spring oats, spring wheat, spring barley, spring rye, and spring emmer conducted in the northern, central, and southern sections of Illinois. Data are presented in tabular form and discussed, and the leading oat varieties for each section noted. The tests with the other spring grains in northern Illinois have been too limited to draw definite conclusions. In central Illinois spring barley has given good results, but spring wheat is not deemed likely to become important unless the fall-sown wheat crop winterkills. The small spring grains (with the exception of early oat varieties) are not found well adapted to southern Illinois conditions.

Northern grown seed oats were not found to be sufficiently superior to home grown oats to justify their extra expense.

Characteristics of 31 oat varieties tested at DeKalb, Urbana, and Fairfield are given in tabular form as to maturity, color of kernel, foliage, form of head, and height.

Grain drying, Bernstein (*Illus. Landw. Ztg.*, *36* (*1916*), *Nos. 5, pp. 27–29, figs. 6; 6, pp. 34, 35, figs. 2*).—This article describes in detail several pieces of apparatus devised for the purpose of drying grain on a commercial scale. The construction of the various pieces is discussed and illustrated, and the cost of each piece estimated.

Grading and baling Philippine fibers, H. T. Edwards (*Philippine Agr. Rev.* [*English Ed.*], *9* (*1916*), *No. 1, pp. 5–12, figs. 2*).—The text is given of General Order No. 47, issued by the Government of the Philippine Islands, regulating the grading and handling of fiber crops in the Philippines. The regulations cover three main subjects, (1) designation of the official standard grades for each fiber, (2) determination of the standard grades and types thereof, and (3) additional regulations regarding baling, labeling, and inspection.

One year of the fiber-grading law, M. M. Saleeby (*Philippine Agr. Rev.* [*English Ed.*], *9* (*1916*), *No. 1, pp. 13–20, pls. 2*).—This article discusses the operation of the fiber-grading law noted above.

It is pointed out that by the establishment of standard grades the Government has greatly facilitated the buying and selling of fiber. The educational work among the producers, instructing them in the proper methods of cleaning and handling the fiber, has aided materially in some districts. The distribution of literature pertaining to fiber grading among the commercial houses and the sending out of samples of the standard grades has also proved of great value.

Description of the standard grades of Philippine fibers, M. M. Saleeby (*Philippine Agr. Rev.* [*English Ed.*], *9* (*1916*), *No. 1, pp. 21–30*).—This is a technical description of the standard grades of Philippine fibers as recognized by law.

The standard grades of abacá (Manila hemp) have been classified into four groups, according to the extent of the cleaning, as follows: (1) Those of excellent cleaning, grades streaky No. 3, streaky No. 2, streaky No. 1, midway, good current, superior current, and prime and extra prime; (2) those of good cleaning, grades brown, seconds, and current; (3) those of fair cleaning, grades medium, fair, and good fair; and (4) those of coarse cleaning, grades coarse brown, coarse, and daet. The standard grades of maguey and sisal are grouped

as (1) retted fiber, grades maguey or sisal No. 3, maguey or sisal No. 2, and maguey or sisal No. 1; and (2) knife or machine cleaned fiber, grades maguey or sisal, common, fair, and good.

Fiber-grading stations and grading establishments, M. M. SALEEBY (*Philippine Agr. Rev.* [*English Ed.*], *9* (*1916*), *No. 1*, *pp. 42–47*).—This is a list of the regularly authorized fiber-grading stations in the Philippine Islands.

Statistical report of fiber production in the Philippine Islands during the year 1915, M. M. SALEEBY (*Philippine Agr. Rev.* [*English Ed.*], *9* (*1916*), *No. 1*, *pp. 31–41*, *pls. 3*).—This is a detailed report of fiber production in the Philippines for 1915, showing a grand total of 1,071,983 bales for the year. The production in bales is also given for each province.

The important legumes.—I, Peas, vetches, field beans, lupine, and lentil, C. FRUWIRTH (*Landw. Hefte, No. 29* (*1916*), *pp. 42*, *figs. 9*).—This publication discusses in a popular manner the value of leguminous plants in agriculture. Several specific crops are described and their value, both for human use and for agricultural purposes, discussed. The following varieties are described in detail, together with mention of common local varieties: (1) Peas (*Pisum sativum* and *P. arvense*); (2) field beans (*Vicia faba*); (3) yellow lupine (*Lupinus luteus*) and the narrow-leafed lupine (*L. augustifolius*); (4) vetch (*V. sativa*); and (5) lentil (*Lens esculenta*).

A device for sorting peas is described and illustrated.

A method for removing the bitter flavor of lupines is described and an apparatus for that purpose illustrated.

Why alfalfa sometimes fails in Iowa, O. F. JENSEN (*Iowa Agr.*, *17* (*1916*), *No. 2*, *pp. 57–60*, *fig. 1*).—This article gives the results of an investigation of 1,300 reports from alfalfa growers in 75 counties of the State of Iowa. The complete failures reported numbered 247, or one out of every six seedings. An analysis of 197 of these failures indicated that the causes were as follows: Lack of inoculation, or lack of lime, or both, 79; smothered by nurse crop, 27; smothered by weeds, 22; winter killed, 18; poor preparation of seed bed, 16; drilled or covered too deep, 12; poor soil, lack of fertility, 8; drought, 5; poor drainage, 4; rains washed out, 4; and poor seed, 2.

Flax culture in South Dakota, A. N. HUME, M. CHAMPLIN, and J. MARTIN (*South Dakota Sta. Bul. 169* (*1916*), *pp. 466–493*, *figs. 11*).—This bulletin is a general discussion of flax culture in an effort to revive interest in flax production in South Dakota. Variety tests, date- and rate-of-seeding tests, and rotation tests have been conducted at the Cottonwood, Eureka, and Highmore substations of the South Dakota Station, and in cooperation with the U. S. Department of Agriculture on the Belle Fourche Experiment Farm, Newell, S. Dak.

The flax commonly grown in South Dakota is of the small-seeded, blue-flowered European type, although the pedigreed varieties North Dakota Resistant No. 52 (S. D. 29) and Select Russian N. D. 1215 (S. D. 686) have yielded best in variety tests at Highmore and Newell, respectively. It is recommended that flax follow a pasture, meadow, or cultivated crop, and that the rotation extend over a long period. Several tests of rotation systems are in progress. Early seeding is recommended, April seedings of 2 pk. per acre being deemed preferable to late light seedings. Flax responds to irrigation, but overirrigation and too late irrigation must be avoided. General notes are given on the harvesting, threshing, and disposal of the crop.

Some varieties of Indian gram (Cicer arietinum), A. and GABRIELLE L. C. HOWARD and A. RAHMAN KHAN (*Mem. Dept. Agr. India, Bot. Ser.*, *7* (*1915*), *No. 6*, *pp. 211–235*, *pls. 3*, *figs. 2*).—This bulletin is a description of the varieties of gram (*C. arietinum*), the Indian cold-season food grain, together with a

discussion of the morphological and cultural characteristics of the plant. The area grown to gram every year is approximately 18,000,000 acres and the average yield is 688 lbs. per acre.

Extensive experiments have been conducted at Pusa to determine the cultural requirements of the crop. It has been determined that gram does best on the light soils, and that extensive aeration of the soil is imperative for its successful production. Packing the soil, heavy soils, and too high soil moisture content are limiting factors in gram production. The harmful effects do not appear until flowering time, when the plant will suddenly wilt and the production of an apparently vigorous crop fall off quite appreciably. In addition to these limiting soil factors, humidity and rainfall also act to limit production. High humidity at flowering time results in a greatly reduced setting of pods.

The gram plant is normally a self-fertilized plant, although natural cross-fertilization is known to occur. Several such crosses are reported as occurring at Pusa. The 25 types so far isolated at Pusa are classified, and a key arranged for their identification. Brief descriptive notes for each type are given. A great number of variations in color of blossom and seed are to be noted between the different types. Other striking differences are to be found in the habit of growth and in the root development. The quality of the seed increased as the color of the seed approaches the lighter shades.

A report of the cultural experiments of the German Potato Culture Station for 1915, C. von Eckenbrecher (*Ztschr. Spiritusindus., 1916, Ergänzungsh., pp. 3–52*).—This is a detailed report of the potato culture experiments conducted by this station at its outlying experiment fields for 1915. The plans of the experiments are given in detail, together with the tabulated results with 19 varieties at 32 experiment fields situated in 14 provinces. The meteorological conditions prevailing at each substation from April 1 to October 31 are given in tabular form and discussed, and the results of the experiments since 1892 are summarized for purposes of comparison.

The average yield of all varieties for 1915 showed an increase of 9.7 per cent over that of 1914, but the average starch content showed a decrease of 0.6 per cent. Some notes are also given on disease resistance of the tested varieties at the various substations.

Cuttings for the propagation of potatoes, L. Kiessling (*Deut. Landw. Presse, 43 (1916), No. 4, p. 25*).—Some notes are given on the literature pertaining to the propagation of potatoes by the use of vegetative cuttings other than the tubers. Numerous tests with different varieties are cited showing the possibilities of high production from a small quantity of the mother stock. The use of potato seedlings for propagation work of this sort is also discussed.

Potato variety tests at Kloster Hadmersleben, F. Heine (*Ztschr. Spiritusindus., 1916, Ergänzungsh., pp. 53–61*).—This is a report of variety tests with 14 early, 36 medium late, and 38 late varieties at the Kloster Hadmersleben experiment station for the year 1915. The meteorological conditions for the years 1912 to 1915 are given in tabular form, as well as the average production of the highest yielding varieties for the last five years, and a description of each variety.

Methods and aims in potato breeding, P. Holdefleiss (*Illus. Landw. Ztg., 36 (1916), No. 17, pp. 106–109, figs. 17*).—This article discusses in a general way the necessity and value of selection for improving the potato crop. A number of varieties are illustrated and brief descriptions given. It is recommended that some definite scheme for tabulating the characteristics of the varieties studied be adopted, and a plan for making such reports is submitted.

Solanum commersonii, the swamp potato, SIEBERT (*Illus. Landw. Ztg., 36 (1916), No. 17, pp. 110, 111, figs. 2*).—A variety of tuber-bearing Solanum from South Australia is described and illustrated as *S. commersonii*. The cultural characteristics of the plant are described in detail. A number of experiments are cited, describing the gradual adaptation of the plant and its development into a product of economic value. The species is deemed especially noteworthy for its resistance to cold and disease.

Sudan grass, T. B. HUTCHESON, E. R. HODGSON, and T. K. WOLFE (*Virginia Sta. Bul. 212 (1916), pp. 3–15, figs. 4*).—This bulletin is a general discussion of Sudan grass (*Andropogon sorghum*), its adaptation to Virginia conditions, and its value as a forage crop. Date and rate-of-seeding tests, tests of seeding with cowpeas or soy beans, and seed production experiments conducted at Blacksburg are reported in tabular form and briefly discussed. Analyses of the cured hay of Sudan grass are quoted from Oklahoma (E. S. R., 32, p. 739) and Texas (E. S. R., 33, p. 41).

For hay, seedings of from 30 to 40 lbs. per acre, broadcasted, are recommended as early as all danger of frost is over in the spring and not later than July 1. For seed production, seedings of 20 lbs. per acre, sown in drills from 24 to 30 in. apart, are suggested. Sudan grass may be seeded with cowpeas or soy beans at the rate of 12 lbs. of grass seed to 1 bu. of peas or beans. It is important that the seed be free from Johnson grass, the seed of which it closely resembles.

A summary of the manurial experiments with sugar cane in the West Indies, W. R. DUNLOP (*West Indian Bul., 15 (1915), No. 3, pp. 212–234*).—This article reports 25 years of experimental work with fertilizers on sugar cane in the West Indies. These experiments have been conducted in the Leeward Islands (Antigua and St. Kitts), Barbados, Trinidad, and British Guiana, and the results obtained and conclusions drawn at each place discussed in detail.

Plats of from 1/20 to 1/30 of an acre are recommended for sugar cane experiments. Notes are given on the precision of the West Indian methods, showing the number of plats necessary in fertilizer experiments with sugar cane for a desired percentage difference between average yields when the probable error of one experiment is 12, 15, or 20 per cent.

Sugar cane on the experimental fields.—Crops of 1914, J. B. HARRISON, C. K. BANCROFT, and R. WARD (*Jour. Bd. Agr. Brit. Guiana, 9 (1916), No. 2, pp. 63–93*).—A report of the sugar cane experiments in British Guiana for 1914.

Considerable space is devoted to a discussion of variety tests, including seedlings and hybrids. Several fertilizer experiments are reported. Nitrogenous fertilizers, especially ammonium sulphate, greatly increased the yield of cane, while phosphorous had very little, if any, effect on cane production. Several soil samples were analyzed mechanically and chemically in an effort to determine any changes that were taking place in the soil.

Sweet clover, T. S. PARSONS (*Wyoming Sta. Bul. 110 (1916), pp. 3–15, figs. 4*).—The adaptation of sweet clover to Wyoming conditions is discussed and its use recommended. *Melilotus alba* and *Medicago officinalis* have both been tested.

Cultural experiments indicate that sweet clover is especially valuable in Wyoming to prepare heavy, hard, and poor soils for alfalfa, that it will grow on land too wet or too dry for alfalfa, and that it is more resistant to alkali conditions than the latter. The plant is also adapted to growth under irrigation or under dry-farming conditions, and produces seed freely in either case.

Experiments are in progress to determine (1) the value of sweet clover as a fertilizer for the succeeding crops, and (2) its value in a complete crop rota-

tion, but only the methods of soil preparation, seeding, and yields are discussed at this time. The results indicate that sweet clover will not do so well on well-prepared soil as on that less thoroughly prepared, compactness of the soil seeming to be the essential factor. A yield of 2,930 lbs. of cured hay was secured from a half-acre plat sown to sweet clover after alfalfa and where deep plowing had been impossible, as compared with failure to obtain a stand from plats which had been seeded to grain the two preceding years.

Sulphuric acid treatment of sweet clover seed gave a total germination percentage of 89, as compared with 78 per cent for scarified seed and 48 per cent for untreated seed.

Sweet potato culture, T. C. JOHNSON and J. T. ROSA, JR. (*Virginia Truck Sta. Bul. 19 (1916), pp. 387–415, figs. 13*).—This bulletin deals with the cultivation and marketing of sweet potatoes in the eastern portions of Virginia.

The proportion of grain to straw in varieties of wheat, J. T. PRIDHAM (*Agr. Gaz. N. S. Wales, 27 (1916), No. 4, pp. 229–231*).—Some notes on tests with 55 varieties of wheat at the Cowra Experiment Farm for 1915 are given. The object of these experiments was to estimate the relative productiveness of the varieties and their suitability for hay.

Selection plats.—A reminder to wheat growers, J. T. PRIDHAM (*Agr. Gaz. N. S. Wales, 27 (1916), No. 4, pp. 233, 234*).—Directions are given to farmers for laying out seed plats for the purpose of selecting their own seed wheat.

[Seed corrosion and its prevention], E. MOLZ (*Landw. Wchnschr. Sachsen, 18 (1916), No. 9, pp. 79–81*).—This article deals with the treatment of wheat with formaldehyde and its effect on germination. Varying strengths of formaldehyde were used and the germination of the seed tested in artificial seed beds and in the field. The range of germination in the artificial seed bed was from 14.5 to 96.5 per cent, while in the field the range was from 0 to 85.6 per cent.

The seed situation in Utah, G. STEWART (*Utah Sta. Circ. 23 (1916), pp. 3–31, figs. 12*).—This circular is a general discussion of the selection and testing of seed for planting. Specific directions are given for the testing of cereals, grasses, vegetables and flowers, and potatoes, and for the field selection of seed of the small grains, corn, potatoes, and forage crops.

The seed business in the first year of the war, M. HEINRICH (*Illus. Landw. Ztg., 35 (1915), No. 104, pp. 669, 670*).—This article gives a brief discussion of the German seed situation in respect to prices and the source of the seed for a number of the more common grasses and clovers.

Clover and grass seed for spring sowing, 1916, M. HEINRICH (*Illus. Landw. Ztg., 36 (1916), No. 15, pp. 91, 92*).—This article discusses the average germination, purity, and cost of a number of the more common clover and grass seeds available for sowing in 1916 as compared with the averages for the past 10-year period. The data are presented in tabular form.

[Computing actual values of clover and grass seed], M. HEINRICH (*Deut. Landw. Presse, 43 (1916), No. 8, pp. 57, 58*).—This article describes a method for computing the actual value of a grass or clover seed, based on the following formula: $x=\frac{(R+r)\times(K+k)\times a}{Rg\times Kg}$. In this formula, Rg=guarantied purity of seed; Kg=guarantied germination of seed; R=actual purity; K=actual germination; r=variation in purity; k=variation in germination; and a=stipulated price.

Characteristics of quack grass (Agropyron repens) and western wheat grass (A. occidentale), with special emphasis on the eradication of quack grass, A. N. HUME and S. L. SLOAN (*South Dakota Sta. Bul. 170 (1916), pp. 497–524, figs. 9*).—Quack grass and western wheat grass are described and compared and their habits of growth illustrated. Special emphasis is laid on

the eradication of quack grass, the following methods being recommended, according to local conditions: Hand digging; smothering with tarred paper or mulch; summer fallowing; and grazing or cutting for hay, followed by fallowing.

Observations of the results obtained by several farmers, using modifications of the summer fallow system, indicate that the best results are obtained from cultivation during July and August followed by a cultivated crop. The cost of this operation was estimated at $15 per acre, and the fact is noted that a number of sheep could be purchased for that amount and grazed on the infested land to good advantage. Continued grazing weakens the root stock and brings it nearer the surface.

The root system of western wheat grass is not nearly so strong as that of quack grass, being unable to withstand thorough cultivation.

[The control of hedge mustard with finely powdered kainit], SCHNITZLER (*Illus. Landw. Ztg., 36 (1916), No. 14, pp. 83, 84*).—This article is a discussion of the control of weeds by the use of powdered kainit applied in solution. A list of weeds is given, arranged in the order of their resistance to this treatment.

Two points are considered, the degree of influence of kainit on different weeds and why cereals are not injured by the use of kainit. Three reasons are advanced to show why different weeds are affected in varying degrees, (1) that plasmolysis varies in different plants due to protective structures, (2) that the hairy growth on certain plants serves as a mechanical protection, and (3) that the oily coating found on several plants furnishes a protection. The immunity of cereals is attributed to certain cultural characteristics, such as the arrangement of the leaves, upright habit of growth, and the high osmotic pressure developed in the cells of the plant.

Weeds of New South Wales, J. H. MAIDEN (*Agr. Gaz. N. S. Wales, 27 (1916), No. 4, pp. 247–253, pls. 2*).—This is a popular and botanical description of two weeds of New South Wales, the cape weed (*Cryptostemma calendulacea*) and Hexham scent (*Melilotus parviflora*), including a brief discussion of cultural characteristics and methods of control.

HORTICULTURE.

Johnson's gardeners' dictionary and cultural instructor, G. W. JOHNSON, edited by J. FRASER and A. HEMSLEY (*London: George Routledge & Sons, Ltd. [1917], new ed., pp. 923*).—The present edition of this old English work, although based on the original edition of 1846, has been thoroughly recast and brought down to the year 1917, both from the standpoint of plant nomenclature and cultural practices. Many thousand names of new plants have been added.

The complete gardener, H. H. THOMAS (*London and New York: Cassell & Co., Ltd., 1916, 4. ed., pp. XVI+579, pls. 128, figs. 72*).—A manual of information relative to the more desirable hardy flowers, greenhouse flowers, evergreen and blossoming shrubs, fruits, and vegetables, including directions for their culture under glass and in the open.

Garden planning and planting, edited by H. H. THOMAS (*London and New York: Cassell & Co., Ltd. [1915], pp. [VI]+150, pl. 1, figs. 138*).—A popular treatise on the subject.

Gardening made easy, edited by E. T. COOK (*London: Country Life, 1916, 6. ed., pp. 217, figs. 24*).—A popular treatise on ornamental and vegetable gardening in the open and under glass, including also a chapter on fruit culture.

Kitchen and market gardening, L. BUSSARD (*Culture Potagère et Culture Maraîchère. Paris: J. B. Baillière & Sons, 1916, 3. ed., rev. and enl., pp. 524,*

figs. 215).—The present edition of the author's work (E. S. R., 15, p. 674), which is one of a series constituting the agricultural encyclopedia published under the direction of G. Wery, has been completely revised to include more recent knowledge relative to amateur and professional gardening practices.

[Overhead irrigation results in 1916], E. F. PALMER (*Agr. Gaz. Canada, 4 (1917), No. 2, pp. 125–127, fig. 1*).—Some data are given on tests of overhead irrigation conducted with raspberries and vegetables by the Ontario Horticultural Experiment Station, Vineland, in 1916. The results in brief indicate that overhead irrigation may be used with considerable profit during periods of drought.

Cucumber growing, C. P. HALLIGAN (*Michigan Sta. Circ. 30 (1916), pp. 4*).—A revision of Circular 19 of the station previously noted (E. S. R., 29, p. 145).

Commercial onion growing, C. B. SAYRE (*Indiana Sta. Circ. 57 (1916), pp. 27, figs. 12*).—This circular describes the most successful practice in the commercial production of onions on the muck lands of northern Indiana. The subject matter is based upon observations, correspondence, and special field studies conducted by the author in 1915 and 1916, supplemented by observations made by W. E. Lommel in 1915. In addition to details for growing, harvesting, and marketing the main onion crop, information is also given relative to the production of onion sets, onions for pickling, and onion seed, including directions for the control of insects and diseases.

The use of brine tank refrigerator cars for fruit shipments (*Agr. Gaz. Canada, 4 (1917), No. 2, pp. 110–114, figs. 8*).—A summarized account of experiments conducted with the brine tank refrigerator car by the Dominion Department of Agriculture during the season of 1916. With the use of 5 per cent salt and crushed ice in conjunction with slatted floor racks a good brine tank car has given very much more satisfactory results than a poor block ice car.

The relation of fruit growing to soil fertility, R. C. THOMPSON (*Arkansas Sta. Bul. 123 [tech. ed.] (1916), pp. 3–20*).—A technical edition of the bulletin previously noted (E. S. R., 36, p. 39).

The Indiana farm orchard operating costs and methods, C. G. WOODBURY, M. W. RICHARDS, and H. J. REED (*Indiana Sta. Bul. 194 (1916), pp. 3–79, figs. 56*).—This bulletin discusses the conditions of success in the renovation and operation of farm orchards, outlines the conditions underlying successful fruit growing in such a way as to enable orchard owners to form a correct judgment in regard to their own opportunities, and presents figures on operation costs in several farm orchards as summarized from records compiled during the last five years.

The data on operation costs were secured from eight orchards located in several fruit-growing districts of the State and ranging in size from 4 to 30 acres. The cost of the various operations are given in detail in most cases for each season and averaged for the 5-year period, both for the individual orchards and the orchards as a whole. Summarizing the data as a whole for all of the orchards during the 5-year period the total management cost was $1.37 per tree, $56.68 per acre, 44.7 cts. per bushel, and $1.35 per barrel. The average yield per acre was 232.4 bu.

On the cause of alternate bearing in the apple, O. BUTLER (*Bul. Torrey Bot. Club, 44 (1917), No. 2, pp. 85–96, pls. 3, fig. 1*).—After reviewing the investigations conducted at the New Hampshire Experiment Station, as well as at other state stations and abroad, the author concludes that to obtain regular fruitfulness in apple trees of bearing age the yearly departures from the mean growth must be small. Pruning may be considered as the most potent means of regularizing bearing; in fact, the only really effective means of accomplishing this object.

The identification and classification of pears, G. LUIZET (*Jour. Soc. Nat. Hort. France, 4. ser., 17 (1916), May, pp. 74–78; abs. in Internat. Inst. Agr.* [*Rome*], *Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 8, pp. 1119, 1120*).—An outline is here given of a scheme for identifying and classifying pears that has recently been worked out by L. Chasset and is to be published in full at a later date.

Origin and development of hardy, blight-resisting pears, C. G. PATTEN (*Minn. Hort., 45 (1917), No. 3, pp. 97–102, pl. 1, figs. 2*).—A popular review of the work of the author and other investigators in the attempt to secure hardy, blight-resisting pears for culture in the United States.

The cherry and its industrial culture, A. A. HINZENBURG (*Vishnia i eia Promyshlennaia Kultura. Petrograd: Imp. Ross. Obshch. Plod., pts. 1 (1914), pp. 108, figs. 48; 2 (1915), pp. 111, figs. 65*).—Part 1 of this work deals with the description and classification of cherries, together with various cultural operations. Part 2 takes up the diseases and pests of cherry trees and methods of control. The methods of harvesting and packing cherries and the preparation of various cherry products are also considered.

Variations of a sexual hybrid of the vine by grafting it on one of its procreators, F. BACO (*Compt. Rend. Acad. Sci.* [*Paris*], *163 (1916), No. 23, pp. 712–714*).—In continuation of previous studies on variations in grafted grapevines (E. S. R., 29, p. 148), the author here reports a case in which a hybrid when used as a scion changed its mosaic and general appearance and assumed latent characters of the stock and of one of its maternal ancestors.

The hybrid direct bearers in the valley of the Rhone in 1916, A. DESMOULINS and V. VILLARD (*Prog. Agr. et Vit.* (*Ed. l'Est-Centre*), *38 (1917), Nos. 2, pp. 36–42; 3, pp. 59–62*).—In continuation of previous data (E. S. R., 35, p. 41), observations are given for the seventeenth year relative to the behavior of a large number of hybrid direct-bearing grapes, with special reference to their resistance to disease, adaptation to various soil conditions, and relative time of budding.

Blueberry culture, ELIZABETH C. WHITE (*Woman's Nat. Farm and Gard. Assoc., 3 (1917), No. 3, pp. 3–10*).—The author describes in detail methods employed in preparing a piece of swamp land for blueberry culture and in the propagation and planting of selected wild blueberries. The work was conducted at Whitesbog, N. J., in cooperation with the U. S. Department of Agriculture (E. S. R., 35, p. 647).

Fertilizer experiments with cranberries in 1916, F. P. SCHLATTER (*Proc. Amer. Cranberry Growers' Assoc., 47 (1917), pp. 13–16*).—A summary of results secured in 1916 in cooperative experiments being conducted under the direction of the New Jersey Experiment Stations (E. S. R., 34, p. 834).

The results of the work thus far secured indicate that sandy bogs respond favorably to fertilizer treatment, but that it is unwise to apply fertilizers in any great amount to muck bottom bogs, with the possible exception of those fertilizers carrying phosphorus.

The continued increased yield in sandy land in 1916 is attributed to the residual effect of fertilizer, since none of the plats were fertilized since 1915.

Progress in vegetative propagation of tropical fruits, P. J. WESTER (*Philippine Agr. Rev.* [*English Ed.*], *9 (1916), No. 3, pp. 257, 258*).—The author gives brief directions for the propagation of a number of species of tropical fruits. The directions are based upon work conducted at the Lamao Experiment Station.

History of the avocado and its varieties in California with a check list of all named varieties, I. J. CONDIT (*Mo. Bul. Com. Hort. Cal., 6 (1917), No. 1, pp. 1–21, figs. 5*).—In addition to brief historical notes on the avocado in

California, 54 varieties originating in the State and 86 varieties originating elsewhere are here listed.

The cultivation and fertilization of the avocado in Florida, W. J. Krome (*Cal. Citrogr., 2 (1917), No. 4, pp. 12, 21, 22, fig. 1*).—The author's methods of cultivating and fertilizing avocado trees as experimentally developed during the past few years are here described.

Inherent characteristics of Theobroma cacao, and a summary on cacao experiments, F. E. Olivieri (*Proc. Agr. Soc. Trinidad and Tobago, 16 (1916), No. 12, pp. 461–474*).—A description of the inherent characteristics of the cacao tree, together with a brief summary of some of the more important investigations dealing with cacao.

Note on the species and varieties of coffee grown in Java, P. J. Wester, trans. by H. Maury (*Bul. Écon. Indochine, n. ser., 19 (1916), No. 121, pp. 624–637*).—A French translation of the author's article previously noted (E. S. R., 35, p. 745).

The cultivation of guavas in Gujarat, L. B. Kulkarni (*Dept. Agr. Bombay Bul. 79 (1916), pp. 14, pls. 3*).—An account of native methods of growing guavas in different sections of Gujarat, including analyses of soil and fruit, estimated data on the cost of growing guavas, and brief suggestions relative to improvement in cultural methods.

Effect of fertilizers on the composition and quality of oranges, H. D. Young (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 4, pp. 127–138*).—In connection with a continuous fertilizer experiment started by the California Experiment Station in 1907, and which has been reported on from time to time (E. S. R., 36, p. 138), a study was undertaken in 1914 and 1915 relative to the effect of the various fertilizers on the quality and composition of oranges. Analytical data are given and discussed both for Valencia and navel oranges fertilized differently, for oranges grown on light and heavy soil, and fertilized with commercial fertilizer and with organic matter. Other investigations along similar lines are briefly reviewed.

Nitrogen was the only element which seemed to exercise a specific effect on the composition of the oranges. No great differences in composition were observed between oranges fertilized with commercial fertilizer and with organic matter. Likewise, oranges grown on a light soil and a heavy soil did not show material difference in composition under the same fertilizer treatment. Applications of nitrogen to the soil resulted in a slightly lower amount of sugar, a somewhat coarser fruit, and a little less juice in the orange, regardless of whether the nitrogen was in combination with either potash or phosphoric acid, or both. The effects of nitrogenous fertilizers were greater in the 1915 crops, which were harvested about two months later than the 1914 crops, thus indicating that nitrogen produced an effect other than that of merely delaying the time of maturity. A comparison with fruit from similar trees grown outside the fertilizer plats showed a fair agreement of composition and quality. The analyses show a higher percentage of nitrogen from all plats receiving it, while no such effect was obtained with either phosphoric acid or potash.

Notes on medicinal plants, A. Hosking (*West of Scot. Agr. Col. Bul. 78 (1917), pp. 99–149*).—This bulletin discusses the possibilities and limitations of the cultivation and collection from wild sources of medicinal plants in Scotland, gives directions for growing herbs, and presents a list of hardy herbs, trees, and shrubs used in medicine.

Collection, drying, and cultivation of medicinal plants in Russia, V. L. Komarov (*Sbor, Sushka i Razvedenie Lekarstvennykh Rasteniĭ v Rossii. Petrograd: Dept. Zeml., 1916, 2. ed., pp. 128, pls. 66*).—A manual of information relative to the collection, drying, and cultivation of medicinal plants, including

descriptive lists of plants adapted for culture in different parts of Russia and reports from experimental cultures undertaken as a result of the distribution of seeds and plants in different parts of the country.

Notes on cinchona in Java, P. J. Wester (*Philippine Agr. Rev.* [*English Ed.*], *9* (*1916*), *No. 4*, *pp. 273–277*, *pls. 3*).—A brief account of methods employed in growing cinchona in Java, based on a report made by the author in 1915 after a visit to Java.

Bulb growing for amateurs, H. H. Thomas (*London and New York: Cassell & Co., Ltd., 1915, pp. VIII+151, figs. 148*).—A popular treatise on bulb culture under glass and in the open, with suggestions relative to varieties adapted to different seasons and situations.

Gladiolus studies.—I, Botany, history, and evolution of the gladiolus, A. C. Beal (*N. Y. State Col. Agr., Cornell Univ., Ext. Bul. 9* (*1916*), *pp. 93–188*, *pl. 1*, *figs. 7*).—This is the first contribution on gladiolus studies undertaken by the department of horticulture in 1910 and later continued by the department of floriculture of Cornell University in cooperation with the American Gladiolus Society.

The present bulletin traces the development of the gladiolus up to the present time. The subject matter is discussed under the following headings: Botany of the gladiolus; history of the genus; evolution of the gladiolus, including history of garden species, hybrid gladioli, and history of gladiolus in America; and bibliography of the gladiolus, including botanical works, special works, references to history and development, color plates and figures of gladiolus species, hybrid gladioli, and horticultural varieties.

Gladiolus studies.—II, Culture and hybridization of the gladiolus, A. C. Hottes (*N. Y. State Col. Agr., Cornell Univ., Ext. Bul. 10* (*1916*), *pp. 189–271*, *pl. 1*, *figs. 29*).—In continuation of the above, the present bulletin discusses the culture and hybridization of gladiolus, the subject matter being based on four years' observations made at the trial grounds of the American Gladiolus Society at Cornell University, on conversations and correspondence with many gladiolus experts, and on a review of the literature of the subject.

The following phases are discussed: The gladiolus as a cut flower and as a garden subject; soils for the gladiolus; fertilizers and their use; time and manner of planting; spring and summer culture; the gladiolus bloom; ideals in flower and in growth; hybrids and hybridization, including a general discussion, crossing technique, and suggested improvements; gathering and planting seeds; methods of propagation; indoor culture; insect and animal pests; and gladiolus diseases. An extensive bibliography of related literature is appended.

A report on varieties tested at Cornell University will be issued at a later date.

Field notes on sweet peas, edited by L. L. Morse (*San Francisco, Cal.: C. C. Morse & Co.* [*1916*], *rev. ed., pp. 220, figs. 12*).—The present edition of this work includes 1,870 varietal names of sweet peas that have been listed either in American, British, or Australian publications. Historical notes are given on the various classes and types, the varieties are listed according to color and preference, and the varieties are then described with reference to the introducer, year of introduction, color and character of bloom, and similar varieties. Notes are also given on Mendelism in sweet peas, culture, and insect troubles.

Everybody's flower garden, H. H. Thomas (*London and New York: Cassell & Co., Ltd., 1916, pp. VII+152, figs. 118*).—A popular treatise on ornamental gardening, including information relative to the development of various types of gardens and plants adapted for each.

Studies in gardening, A. CLUTTON-BROCK (*New York: Charles Scribner's Sons, 1916, pp. XXXVIII+337*).—An American edition of the author's work, edited and annotated by Louisa Y. King. The work as a whole comprises a collection of some 30 articles upon both the theory and practice of ornamental gardening that originally appeared in the form of letters in the *London Times.*

Garden ornaments, MARY H. NORTHEND (*New York: Duffield & Co., 1916, pp. [XI]+178, pls. 32*).—A popular work dealing with the treatment of the garden path and border, steps, entrances, seats, and other garden accessories, such as the pergola and arch, bird baths, pools, sundials, fountains, etc.

FORESTRY.

Some public and economic aspects of the lumber industry.—Studies of the lumber industry, I, W. B. GREELEY (*U. S. Dept. Agr. Rpt. 114 (1917), pp. 100, pls. 3, figs. 14*).—This comprises the first report on a study of the conditions in the timber-using industries conducted by the Forest Service in cooperation with the Bureau of Corporations and later with the Federal Trade Commission. The investigation as a whole was conducted to obtain the facts necessary to an understanding of the lumber industry and the further development of a public forest policy.

The present report presents a general view of the whole investigation under the following general headings: The industrial side of forest conservation, present conditions in the lumber industry, why the lumber industry is unstable, how the public is concerned, what the situation calls for, the use of public timber, and a public forest policy. Detailed studies are to be presented in subsequent publications.

The essentials of American timber law, J. P. KINNEY (*New York: John Wiley & Sons, Inc., 1917, pp. XXI+279+X*).—A presentation of the existing laws regarding trees and their products as property, with certain observations and references to historical development deemed necessary to an understanding of the reasons for existing laws. The general interpretation of the laws is accompanied in each case by page citations to the compiled laws of the different States on the subject.

Instructions for the scaling and measurement of National Forest timber (*U. S. Dept. Agr., Forest Serv., 1916, pp. 94*).—The instructions contained in this pamphlet are supplementary to the National Forest Manual (E. S. R., 26, p. 340) and are intended for use in the administration of timber sales, timber settlements, timber trespass, free use, and other administrative use.

Historical review of Canada's timber industry, J. LAWLER (*Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 9, pp. 1227–1234*).—The author sketches the genesis and development of timber regulations in Canada since the French régime.

The forest trees of Canada, R. G. LEWIS (*Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 9, pp. 1234–1241*).—A list is given of the coniferous and deciduous tree species of Canada, including brief notes on some of the more important timber species.

Commercial woods of the Philippines: Their preparation and uses, E. E. SCHNEIDER (*[Philippine] Bur. Forestry Bul. 14 (1916), pp. 274, pls. 10, figs. 12*).—This bulletin replaces Bulletin 11 of the Bureau of Forestry (E. S. R., 28, p. 439). The scope of the work has been considerably extended by the addition of much new material and related material gathered from various publications. The principal works consulted are here listed.

The subject matter is discussed under the headings of forests, timber supply, markets; properties of wood, methods of conversion, working and finishing,

preservative treatment; uses; methods of identification; and species descriptions. Data on the mechanical properties of 34 Philippine woods, shipping weights, grading rules, and lists of woods based on the durability of sapwood are appended.

The trees of North Carolina, W. C. Coker and H. R. Totten (*Chapel Hill, N. C.: W. C. Coker, 1916, pp. 106*).—This work contains popular descriptions of the trees of North Carolina, including a key for the identification of the species.

Western yellow pine in Oregon, T. T. Munger (*U. S. Dept. Agr. Bul. 418 (1917), pp. 48, pls. 7*).—An account of the western yellow pine in Oregon, discussing its distribution and abundance, distinguishing characteristics, climatic and soil requirements, reproduction, effects of fire, sources of injury other than fire, character of the stands, growth, characteristics of the wood, utilization of yellow pine forests, logging and milling, planting, and management. Volume tables for western yellow pine, instructions for marking timber in the yellow pine region, and instructions for brush burning under the selection system of cutting are appended.

Hybrids and other new chestnuts for blight districts, W. Van Fleet (*North. Nut Growers Assoc. Proc., 7 (1916), pp. 54–58*).—A paper on this subject read before the annual meeting of the Northern Nut Growers' Association, Washington, D. C., in September, 1916.

Fourth biennial report of the state forester, J. C. Van Hook (*Bien. Rpt. State Forester, Mont., 4 (1915–16), pp. 55, pl. 1, figs. 15*).—A report of activities during the fiscal years 1915 and 1916, including information relative to timber resources and timber industries of the State, qualities and uses of the more important Montana woods, progress in wood preservation, fire protection, instructions for farm and city tree planting, and brief descriptions of some of the mountain forests of Montana as places for recreation.

Report of the state forester to the State Board of Forest Commissioners for the period ended November 30, 1914, E. W. Ferris (*Ann. Rpts. Wash. State Forester, 1913–14, pp. 29*).—This report deals primarily with private, state, and federal activities in forest protection in Washington forests during the biennial period ended November 30, 1914.

Annual reports Washington state forester for the years ending November 30, 1915 and November 30, 1916, E. W. Ferris and F. E. Pape (*Ann. Rpts. Wash. State Forester, 1915–16, pp. 41, pls. 6*).—These reports deal primarily with fire protection work conducted during 1915 and 1916.

Annual progress report upon state forest administration in South Australia for the year 1915–16, W. Gill (*Ann. Rpt. State Forest Admin. So. Aust., 1915–16, pp. 13, pls. 6*).—A statistical review relative to the administration and management of the state forests of South Australia, including data on alterations in forest areas, planting and other forest operations, revenues, expenditures, etc.

DISEASES OF PLANTS.

Prophylaxis in vegetable pathology, O. Comes (*La Profilassi nella Patologia Vegetale. Naples: R. Ist. Incoragg. Napoli, 1916, pp. 173*).—This comprises a short introduction, historical in character, and two main sections. The first of these deals with susceptibility as related to climate, soil, cultivation, and nitrogen manuring. The second deals with resistance as related to the various regions of the plant, to the chemistry of the tissues and juices, to oxidases, to selection, and to phosphate fertilizers.

Diseases of cultivated plants. Nonparasitic diseases, G. Delacroix. **Parasitic diseases,** G. Delacroix and A. Maublanc (*Maladies des Plantes Cultivées. Maladies non Parasitaires. Maladies Parasitaires. Paris: J. B. Ballière*

& Sons, 1916, vol. 1, pp. XII+420, figs. 113; vol. 2, 2. ed., pp. 447, figs. 656).—These volumes form a part of the agricultural series prepared under the direction of G. Wery. The first treats of nonparasitic diseases, or those the causes of which are not definitely known. It also contains chapters on parasitism, symbiosis, immunity, etc.

The second volume describes and discusses bacterial and fungus diseases, as well as the injuries and abnormalities produced by Cuscuta, mistletoe, etc. The earlier edition of the second volume has already been noted (E. S. R., 21, p. 146).

Report of the botanist and plant pathologist, H. W. BARRE (*South Carolina Sta. Rpt. 1916, pp. 16–20*).—The lines of investigation reported upon are essentially the same as those previously noted (E. S. R., 34, p. 643).

In the study of cotton anthracnose, methods of securing disease-free seed have been given attention, field selections, hot water treatments, and field tests with old seed having been made. By careful selection, removal of diseased bolls before picking, and the treatment of seed from disease-free stalks with sulphuric acid before planting, it has been found possible to eliminate anthracnose, even from some of the badly diseased varieties. Further tests of old seed kept in the office and laboratories show that three-year-old seed gives disease-free plants. Seed claimed by farmers to have been kept for three years in sheds and barns did not give as satisfactory results as were obtained at the station. Further spraying tests with Bordeaux mixture gave results similar to those reported previously.

The excessive rains during July seriously interfered with the work on the investigation of cotton shedding, but it was found that excessive soil moisture during the blooming season caused as much shedding and as great injury to plants as do long periods of drought. During the past year soil temperatures have been taken, and records of temperatures from different depths are available in connection with other physiological data.

The investigation of the angular leaf spot of cotton has been continued along the same lines as indicated in Bulletin 184 of the station (E. S. R., 35, p. 652), and considerable data secured with reference to the occurrence of the disease, its abundance and spread, methods of dissemination and infection, conditions under which infection takes place, etc.

Brief notes are given of preliminary work on the breeding of cotton, reforestation of the coastal plain, and cooperative experiments with this Department in the production of cotton and cowpeas resistant to wilt and root knot.

Report of the mycological department of the entomological station in Tula for 1913–14, N. P. TRUSOVA (*Abs. in Mat. Mikol. i Fitopatol. Ross., 1 (1915), No. 4, pp. 122, 123*).—The author gives a list of fungus diseases observed in Province Tula, Russia, in 1913–14, and points out the influence of meteorological conditions on their development. This was especially remarkable in case of the late blight of potatoes, which was very severe in 1913 and practically absent in 1914. Of particular interest is the statement that soda gave satisfactory results in combating the American gooseberry mildew.

Fungus parasites in Province Voronezh collected in the summer of 1912, A. BONDARTSEV (BONDARZEW) and L. DEBEDEVA (*Abs. in Mat. Mikol. i Fitopatol. Ross., 1 (1915), No. 4, p. 124*).—In connection with descriptions of a number of parasites collected by the authors in the summer of 1912, particular interest is said to attach to the finding of *Peronospora polygoni* on buckwheat, as this may be identical with *Peronospora* sp. found on the same host in France. Many new species are added to the class of imperfect fungi, some of which are illustrated and described.

Some observations on fungus diseases of cultivated plants in Turkestan, N. G. ZAPROMETOV (*Otchet Prakt. Mikol. Turkest. Ent. Sta., 1914; abs. in Mat. Mikol. i Fitopatol. Ross., 1 (1915), No. 4, pp. 125, 126*).—Special attention was given by the author to diseases which appeared to be very prevalent in orchards and vineyards of Turkestan. Much damage was done to grapevines by the spotted anthracnose, the disease caused by *Cercospora vitiphylla*, and Oïdium. Among other diseases noted, apple scab and leaf and twig curl of peaches, apricots, and almonds are reported as abundant.

A monograph of the Uredineæ, P. and H. SYDOW (*Monographia Uredinearum seu Specierum Omnium ad Hunc Usque Diem Cognitarum Descriptio et Adumbratio Systematica. Leipsic: Borntraeger Bros., vol. 3, Nos. 1 (1912), pp. 1–192, figs. 83; 2 (1914), pp. 193–416, figs. 76; 3 (1915), pp. 417–726, figs. 36*).—These three numbers deal descriptively and systematically with Pucciniaceæ, Melampsoraceæ, Zaghouaniaceæ, and Coleosporiaceæ through the several species.

The wintering of Coleosporium solidaginis, E. B. MAINS (*Phytopathology, 6 (1916), No. 4, pp. 371, 372*).—According to the author, *C. solidaginis* has been found wintering over in the rosette leaves of *Solidago* sp., both as mycelium and uredospores.

The mosaic disease of tomatoes and petunias, H. A. ALLARD (*Phytopathology 6 (1916), No. 4, pp. 328–335, figs. 2*).—While engaged in the study of the distribution of the virus causing mosaic disease in tobacco plants, the author also carried on parallel experiments with tomatoes and petunias affected with the same disease.

In comparison with the disease obtained by inoculation with the virus of mosaic-diseased tobacco, tomato or petunia plants inoculated with the virus of other solanaceous plants affected with the mosaic disease show no appreciable difference in the incubation period, symptoms, etc. With the exception of slight variations in the external symptoms produced in these host plants, the author considers that the mosaic disease of tobacco affects the petunia and tomato in quite the same manner as it affects the tobacco plant.

A bacterial disease of western wheat grass (Agropyron smithii), P. J. O'GARA (*Phytopathology, 6 (1916), No. 4, pp. 341–350, pls. 5*).—A detailed account is given of an investigation of a bacterial disease of wheat grass due to *Aplanobacter agropyri* n. sp., a preliminary account of which has already been noted (E. S. R., 34, p. 349).

Notes on an artificial culture of Rhizoctonia crocorum, W. W. DIEHL (*Phytopathology, 6 (1916), No. 4, pp. 336–340, fig. 1*).—The author reports having grown *R. crocorum* from alfalfa on synthetic media and having found that the fungus made a very slow growth on the media used. The peculiar cultural characteristics of the organism are considered to indicate that its metabolism, in artificial cultures at least, is affected by an accompanying species of Fusarium.

Sclerotinia blight, a serious disease of snap beans caused by S. libertiana, J. A. MCCLINTOCK (*Virginia Truck Sta. Bul. 20 (1916), pp. 419–428, figs. 4*).—A popular account is given of a disease of snap beans caused by *S. libertiana*, which appeared in the vicinity of Norfolk, Va., in 1915. The disease developed after a period of several days of hot, damp weather, and the fungus appeared upon the stems, branches, leaves, and pods, causing considerable loss. In addition to the attack in the field, secondary losses were caused by the fungus on diseased pods spreading to healthy pods in transit to market.

Experiments in the control of the disease showed marked variation in resistance to the blight, some varieties being almost wholly unaffected. For control of the trouble the author recommends the burning over of the fields so as to destroy as much rubbish as possible and the rotation of crops, avoiding

the planting of beans, lettuce, cucumbers, eggplants, etc., which are known to be attacked by this fungus.

Physiology of Bacterium malvacearum, R. C. FAULWETTER (*South Carolina Sta. Rpt. 1916, pp. 49–64*).—Results of a laboratory study on the physiology of *B. malvacearum*, the cause of the angular leaf spot of cotton, are given, the studies having been conducted in the hope that some insight into the factors as related to parasitism might be secured. In order to obtain data regarding parasitism it is considered important to know the normal physiology of the parasite, its development, dissemination, and control. The author describes the morphology and physiology of the organism when grown in various media, the inhibiting factors of its growth, viability in cultures, etc.

A rot of endive, J. RITZEMA BOS (*Tijdschr. Plantenziekten, 21 (1915), No. 5–6, pp. 169–186*).—A rot of endive is described as due to the fungus *Marssonia panattoniana.*

Studies upon the blackleg disease of the potato, with special reference to the relationship of the causal organisms, W. J. MORSE (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 3, pp. 79–126*).—After giving a historical review of this potato disease, its character and appearance, geographic distribution, economic aspects, etc., are described. On account of its resemblance to a disease reputed to be due to different species of bacteria, the author has made a study at the Maine Experiment Station of the various organisms that have been isolated and described, in different parts of Europe and Canada, as being the cause of the blackleg of the stem of the potato and the attendant decay of the tubers. For this purpose material for study was obtained of *Bacillus atrosepticus, B. phytophthorus, B. solanisaprus*, and *B. melanogenes*, comparisons being made with material isolated by the author from diseased potatoes in Maine. The morphology, cultural relations, physical and biochemical characters, and pathogenicity of the different species are described at length.

From the tests made under the same conditions the author concludes that cultures received under the names *B. atrosepticus, B. solanisaprus*, and *B. melanogenes*, together with three strains of organisms isolated from potato plants in widely separated parts of Maine are apparently identical and should be classed as one species, or at most, as strains of a single species. The organisms received from two sources, under the name *B. phytophthorus*, proved to be not alike, nor did they agree with that species as originally described.

Concerning the nomenclature of the species the author has adopted the name *B. atrosepticus*, and a revised description of the organism is given.

Potato wilt and tuber rot caused by Fusarium eumartii, R. J. HASKELL (*Phytopathology, 6 (1916), No. 4, pp. 321–327, figs. 3*).—The author reports on the pathogenicity of a species of Fusarium on the vines as well as on the tubers of potato plants.

The disease was first noted on tubers in the winter of 1914, and a fungus isolated which seems to be identical with that described by Carpenter (E. S. R., 34, p. 246). As a result of pure culture inoculations, both in the greenhouse and out-of-doors and on sterilized and unsterilized soil, it is demonstrated that *F. eumartii* may produce both a wilt of the potato vine and a rot of the tuber.

History and cause of the rind disease of sugar cane, J. R. JOHNSTON (*Jour. Bd. Comrs. Agr. P. R., 1 (1917), No. 1, pp. 17–45, pl. 1*).—The symptoms of the rind disease of sugar cane due to *Melanconium sacchari* are described. The author claims that this organism is a wound parasite capable of infecting cane only through wounds or cane that is in an otherwise unhealthy condition. It may, however, become actively parasitic on certain varieties of cane which are characterized by weak, soft growth.

For the prevention of the disease the planting of hardy varieties, the adoption of methods that will reduce the moth borer, and the grinding of cane before it is overripe are recommended. Two related fungi, *M. saccharinum* and *M. iliau*, both of which have been reported as attacking cane, are not considered as causing the rind disease.

A bibliography of the subject is appended.

Resistance in fruits, D. Riaboĭ (*Biul. Vred. Selsk. Khoz.* [*etc*], *No. 4*, (*1915*), *p. 1; abs in Mat. Mikol. i Fitopatol Ross.*, *1* (*1915*), *No. 4*, *pp. 121*, *122*).—As a result of his studies of the resistance in fruits to apple scab, the author states that smooth and shiny varieties are more susceptible to this disease than those which have dull, rough, or waxy surfaces.

The root rot disease of the apple in Virginia, F. D. Fromme and H. E. Thomas (*Science, n. ser.*, *45* (*1917*), *No. 1152*, *p. 93*).—According to the authors, the root rot of apples in Virginia, which is said to be prevalent in the chief orchard districts of the State, is apparently due to a species of Xylaria. They report having found perithecial stromata of *X. polymorpha* in various stages of typical root-rot attack, and cultures obtained from this fungus are being used for additional experiments.

Temperature relations of apple rot fungi, C. Brooks and J. S. Cooley (*U. S. Dept. Agr., Jour. Agr. Research*, *8* (*1917*), *No. 4*, *pp. 139–164*, *pls. 3*, *figs. 25*).—A study has been made of a number of species of fungi to determine the temperature relations in connection with the general application of cold storage to fruits. The following species of fungi have been studied at different temperatures and under various conditions: *Alternaria* sp., *Botrytis cinerea*, *Cephalothecium roseum*, *Fusarium radicicola*, *Glomerella cingulata*, *Neofabræa malicorticis*, *Penicillium expansum*, *Sclerotinia cinerea*, *Sphæropsis malorum*, and *Volutella fructi*.

In inoculation experiments with the above species of fungi, all grew at 0° C. except the species of Fusarium and Glomerella. The former made no growth at 15, and the latter none at 10°. *Sphæropsis malorum* produced no evident rot in one week's time at 15°, nor Penicillium and Neofabræa at 10° in two weeks, while *Sclerotinia cinerea* produced measurable rots at 5° in one week, and at 0° in two weeks. The optimum temperature for *N. malicorticis* was 20, for *F. radicicola* 30, and for the other fungi 25°. With most of the organisms the growth rate dropped off rapidly above 25, but with the exception of *N. malicorticis* all made some growth at 30°. With most of the fungi the initial incubation stages of growth on the fruit are more inhibited by low temperatures than the later stages, and results obtained show the importance of immediate as compared with delayed cold storage.

A Phytophthora rot of pear, T. A. C. Schoevers (*Tijdschr. Plantenziekten*, *21* (*1915*), *No. 5–6*, *pp. 153–159*).—A rot of pears noted at Bennekom is described, which is thought to be due to *P. omnivora* (*P. cactorum*).

Peach scab in Netherlands, T. A. C. Schoevers (*Tijdschr. Plantenziekten*, *21* (*1915*), *No. 1*, *pp. 26–29*, *pl. 1*; *abs. in Ztschr. Pflanzenkrank.*, *25* (*1915*), *No. 6*, *p. 365*).—Black scab spots on peaches in Gendringen contained a fungus said to be *Cladosporium carpophilum*. *Monilia fructigena*, the cause of brown rot, was also present in abundance.

A root disease of prunes, Mina A. Willis (*Phytopathology*, *6* (*1916*), *No. 4*, *pp. 368*, *369*).—The author reports the appearance in the summer of 1915 of a peculiar prune disease in the western part of the Snake River Valley, Idaho. In the early part of the season the trees are said to have been apparently normal, but later they wilted and died. Examination showed the entire root system had been destroyed. The sap from diseased trees had a peculiar odor, from which the local name of sour sap was probably derived.

No organism was found to cause the disease. It is believed that a lack of moisture during the preceding fall and winter had caused the smaller roots to dry and die. After the trees had put out their leaves and formed fruit, the increasing dryness of the air made such demands for water that death of the tree resulted.

[Reports on grape downy mildew] (*Rev. Vit.*, *44* (*1916*), *Nos. 1125, pp. 64–66; 1127, pp. 97, 98; 1128, pp. 114–117; 1129, pp. 121–134; 1130, pp. 137–156*).—This continues an account of reports from various sections on downy mildew, as made in 1915 and noted previously (E. S. R., 35, p. 352). This is considered the most important body of information yet collected on this subject, on account of the extent of territory involved and the number, scope, and character of the responses made to requests for information, as noted below.

The development and the treatment of downy mildew in 1915, J. CAPUS (*Rev. Vit.*, *44* (*1916*), *Nos. 1131, pp. 157–162; 1132, pp. 181–190, figs. 2; 1133, pp. 201–206, fig. 1; 1134, pp. 217–224; 1135, pp. 237–247, figs. 2; 1136, pp. 253–255; 1138, pp. 289–303; 1140, pp. 325–334, figs. 2; 1141, pp. 341–350; 1142, pp. 357–363; abs. in Compt. Rend. Acad. Agr. France, 2* (*1916*), *No. 22, pp. 619–621*).—Analyzing the large body of information which is noted above, the author gives a compact summary of certain portions with some practical conclusions as deduced therefrom.

It is stated that in spite of the exceptional severity of attacks and of the economic situation in 1915, a number of vine growers were able to save their crops largely or entirely. As in previous years, the preservation of the vines as against mildew was found to depend upon such circumstances as the time of treatment, the proportion of copper employed, and the care used in spreading the fungicides, among which first rank was held by Bordeaux and Burgundy mixture and copper acetate solution.

As usual, there was a period of a few days just previous to the outbreak during which the treatment could be applied with assurance of its absolute efficacy. This favorable period is related, in case of a primary outbreak, to a period of precipitation. Secondary invasions are related to a rain or period of precipitation following a primary invasion. The determination and utilization of a period favorable for treatment requires the services of a specialist for each region, and its efficacy also depends upon the carefulness and thoroughness of its employment.

In the absence of such special information, a fair degree of success has been attained by thorough and careful spraying each time that the conditions led to new growth of the vines. Protection of the grapes requires very careful spraying during the period of inflorescence. The duration of effectiveness of the spray is dependent largely upon the abundance of the spray and upon its copper content. With the exception of certain cases, in which a 1 per cent solution appears to be effective, a strength of 2 per cent is considered to be the lowest that is safe, at least for general practice, especially in years when conditions are such as to favor serious outbreaks, as in 1910 and 1915. For infrequent treatment or late final treatment, a strength of 3 per cent is considered preferable.

Casein is the only material that has up to this time been extensively used in ordinary practice to increase the adherence of the fungicides, but the results from this are said to be satisfactory. Copper fungicides in the form of powders are reliable as regards fungicidal results, when employed at a favorable time. They are not so lasting as are the sprays, but they cause less injury to the fruits. A number of viticulturists employ powdered preparations immediately following the spray. No general superiority of acid

sprays, as such, has been demonstrated by these reports, as practically the same results were obtained by the use of neutral or basic preparations.

Diseases of grapevines in Vardar, P. VIALA (*Compt. Rend. Acad. Agr. France, 2 (1916), No. 20, pp. 561–564; Rev. Vit., 44 (1916), No. 1146, pp. 425–427*).—Giving an account of some parasites injurious to grape stocks in parts of southern Europe and northern Africa, the author describes an attack by a termite (*Calotermes lucifugus*), which, particularly in the hill region of Vardar, enters (by way of the quickly dried and hence poorly cicatrized wounds left by pruning) into the pith and adjacent tissue of grape stock, and is often accompanied by a polyporous fungus (noted also in France), which, if unchecked, destroys the vine in five or six years. An arsenical treatment has been successfully used for both the animal and the fungus parasite. The fungus is said to be very sensitive to the action of oxygen, and is also said to have been controlled for years in some regions by splitting the stock and inserting a stone to keep the wound open to the air, this treatment causing the death of the parasitic fungus.

Grape diseases in Greece, P. VIALA (*Compt. Rend. Acad. Agr. France, 2 (1916), No. 26, pp. 723–725*).—The author quotes a communication from Gennadius addressed to the Academy of Agriculture, in which it is claimed that the procedure above described, though indeed very old, as are others described, is designed only to check too luxuriant vegetation and restore the full fruiting capacity of the vines, various selections from earlier writings being quoted in this connection.

Observations on the distribution of citrus canker, D. B. MACKIE (*Philippine Agr. Rev.* [*English Ed.*], *9 (1916), No. 4, pp. 278–281, pl. 1*).—The author and some of his associates have made a survey of the Philippines to determine the distribution of the citrus canker, and have found the disease present in a number of localities, occurring on different species of Citrus. The presence of the disease in these localities can in many instances be traced to shipments of plants from Manila. The conclusion is reached that, as the disease has not been found in the more remote districts, its introduction into the islands is comparatively recent.

Spore variation in Neopeckia coulteri, J. S. BOYCE (*Phytopathology, 6 (1916), No. 4, pp. 357–359*).—While examining collections of *N. coulteri*, the author reports having observed several of the spores to have become two-septate and sometimes three-septate by the formation of secondary septa. This led to a study of other collections, from which it appears that such behavior of the spores is not uncommon. The triseptate spores of Neopeckia and spores from a species of Herpotrichia on Primula suggest a very close relationship of the two fungi.

Preliminary note on the occurrence of Peridermium balsameum in Washington, H. SCHMITZ (*Phytopathology, 6 (1916), No. 4, pp. 369–371, figs. 2*).—The author reports the occurrence of this rust on the seedlings of *Abies amabilis*. It is said that this is the first record of the species west of the Mississippi Valley.

A successful inoculation of Abies lasiocarpa with Pucciniastrum pustulatum, J. R. WEIR and E. E. HUBERT (*Phytopathology, 6 (1916), No. 4, p. 373*).—The authors have successfully inoculated young needles of *A. lasiocarpa* with *P. pustulatum*, collected on overwintered leaves of *Epilobium angustifolium*.

Successful inoculations of Larix occidentalis and L. europea with Melampsora bigelowii, J. R. WEIR and E. E. HUBERT (*Phytopathology, 6 (1916), No. 4, pp. 372, 373*).—Successful inoculations of the above species of Larix with teliospores of *M. bigelowii* from a willow are reported.

Work on the white pine blister rust in Minnesota, 1916, F. L. Washburn (*[Minn. State Ent. Dept.] Circ. 40 (1916), pp. 19, pl. 1, figs. 6*).—An account is given of work carried on in the summer of 1916 for the eradication of the white pine blister rust, the presence of which was definitely established in a few counties in Minnesota adjacent to the Mississippi River.

The white pine blister rust. Does the fungus winter on the currant? W. A. McCubbin (*Science, n. ser., 45 (1917), No. 1152, p. 87*).—Data are presented that are considered to indicate that the white pine blister rust may winter over on the currant under certain conditions.

Keithia thujina, the cause of a serious leaf disease of the western red cedar, J. R. Weir (*Phytopathology, 6 (1916), No. 4, pp. 360–363, figs. 2*).—The author reports observing a serious leaf disease on the western red cedar (*Thuja plicata*), in the lake region of northern Idaho.

An examination of the material showed that the disease was due to *K. thujina*. This fungus is considered primarily one which attacks seedlings and young trees, but the foliage of the upper crown of forest trees may also be infected, although not to the same extent as the leaves on branches nearer the ground. Evidence is presented which indicates that snow may be a factor in promoting the growth of the organism, as it is particularly noticeable where seedlings remain covered with snow until late spring. A preliminary experiment indicates that the disease may be held in check by spraying seedlings in nurseries with a rather strong soap-Bordeaux mixture.

Note on "spike" disease in sandal, P. M. Lushington (*Indian Forester, 42 (1916), No. 2, pp. 61–65*).—Summarizing what is known of spike in sandal, the author states that it was described, investigated, and reported on in 1902, having at that time been prevalent in Coorg for four or five years.

The disease appears to be very infectious and to spread rapidly. It is thought that birds or insects may possibly be instrumental in spreading it, and no tree once diseased in this way has been known to recover. Observations by a number of persons are given on the various phases of the disease and on different plants showing a similar abnormality. It is stated that in the Kollimalais sandal has been found to be considerably attacked by *Viscum verruculosum*.

A possible cause of "spike" in sandal, T. A. Whitehead (*Indian Forester, 42 (1916), No. 5, pp. 243–247*).—The view is advanced, with supporting observations, that the cause of spike in sandal is undue reduction in the supply of water to the plant in proportion to its growing needs. The suckers produced from the injured roots of an affected tree show the same trouble as do also root suckers which spring up where a spiked tree has been dug up. The degree of the trouble is the same throughout the tree at a given time. When death sets in the ends of the shoots die before the branches. The so-called phyllode in spiked trees is associated with excess starch in stems, twigs, and leaves. It is stated that no spiked tree has been known to recover.

No fungus has been found in connection with the spike disease and no transmission of the disease has been accomplished experimentally. In spiked trees the root ends die and the haustoria are found to be either absent or dead. Both diseased and healthy trees may bear scars, evidencing parasitism. In one case a living haustorium was found on a diseased tree.

Spike has been observed in other trees noted. The rapid spread of the disease, observed by Lushington as noted above, is thought to be due to the overtaxing of a given area by sandal and the consequent relative exhaustion of its means of obtaining water. Spike is thought to be not a disease, but a symptom of increasing inadequacy in the means of securing water. The remedy

suggested is to plant more trees that may serve as hosts or to thin out the sandal.

The occurrence of bamboo smut in America, FLORA W. PATERSON and VERA K. CHARLES (*Phytopathology, 6 (1916), No. 4, pp. 351–356, fig. 1*).—The authors report the occurrence of *Ustilago shiraiana* on *Phyllostachys henonis* grown at Chico, Cal., from importations made from Japan.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Annual report of the governor of Alaska on the Alaska game law, 1916, J. F. A. STRONG (*U. S. Dept. Agr., Bur. Biol. Survey Doc. 105 (1917), pp. 16*).—This, the fourth annual report on the administration of the Alaska game law, covers the fiscal year ended June 30, 1916. Information for the public in regard to the Alaska game law and regulations of the Department of Agriculture, regulations relative to licensed guides and packers in the Kenai Peninsula, and laws passed by the 1915 session of the Alaska territorial legislature for the protection of game animals are contained in appendixes.

The domestic cat, E. H. FORBUSH (*Mass. Bd. Agr., Econ. Biol. Bul. 2 (1916), pp. 112, pls. 21, figs. 21*).—This article deals with the cat as a bird killer, mouser, and destroyer of wild life and discusses means of utilizing and controlling it.

Rats and rat riddance, E. H. FORBUSH (*Mass. Bd. Agr., Econ. Biol. Bul. 1 (1915), pp. 87, pls. 12, figs. 19*).—Previously noted from another source (E. S. R., 35, p. 656).

Bacterium tularense (*Pub. Health Rpts. [U. S.], 31 (1916), No. 17, pp. 1045, 1046*).—This plague-like disease, not uncommon among ground squirrels in California, was observed in a rabbit in March by M. T. Clegg, this being the first record for California. An outbreak of the disease in rabbits in Indiana has been previously reported by Wherry (E. S. R., 33, p. 450).

Land birds of northern New York, E. J. SAWYER (*Watertown, N. Y.: Watertown Bird Club, 1916, pp. 90, pl. 1, figs. 32; rev. in Auk, 33 (1916), No. 4, p. 442*).—A pocket guide to common land birds of the St. Lawrence Valley and the lowlands in general of northern New York.

The food of West Virginia birds, E. A. BROOKS (*W. Va. Dept. Agr. Bul. 15 (1916), pp. 74, pls. 3, figs. 17*).—A study of the economic value of birds of West Virginia, with suggestions for the protection of the most useful species.

The birds of the Isle of Pines, W. E. C. TODD (*Ann. Carnegie Mus., 10 (1916), No. 1–2, pp. 146–296, pls. 6; abs. in Auk, 33 (1916), No. 3, pp. 332, 333*).—This work, incorporating the substance of field notes by G. A. Link and consisting largely of an annotated list of 142 species, includes an outline of the geography and physiography of the Isle of Pines; notes on the climate, previous work, seasonal occurrence, and faunal affinities; a bibliography of 64 titles; etc.

Some common insects and plant diseases of the farm, garden, and orchard, W. E. RUMSEY (*W. Va. Dept. Agr. Bul. 17 (1916), pp. 38, figs. 69*).—A popular illustrated account of the more important insects and plant diseases in West Virginia.

One hundred notes on Indian insects, T. B. FLETCHER (*Agr. Research Inst. Pusa Bul. 59 (1916), pp. V+39, figs. 20*).—These notes relate to insects of economic importance.

[Insects and control measures in South Africa] (*Union So. Africa Dept. Agr. [Pub.], 1915, Nos. 75, pp. 8; 83, pp. 8, figs. 8; 1916, Nos. 5, pp. 10, figs. 4; 6, pp. 7, figs. 6; 7, pp. 7, figs. 4; 8, pp. 8, figs. 8; 9, pp. 6*).—These papers on insect pests and their control in South Africa relate, respectively, to Locust Destruction; The Mally Fruit Fly Remedy for the Prevention of Maggots in Fruit by the

Destruction of the Parent Flies Before Eggs Are Laid; and The Pepper Tree Caterpillar (*Bombycomorpha pallida*), The Potato Ladybird Beetle (*Epilachna dregei*), The Plum Slug Caterpillar (*Parasa latistriga*), (I) Some Destructive Fruit and Flower Beetles, (II) A New Insect Pest of the Peach (*Philagathes lætus*), and The Cucumber and Vegetable Marrow Fly (*Dacus vertebratus*), by D. Gunn.

Notes on insects damaging sugar cane in Queensland, E. JARVIS (*Bur. Sugar Expt. Stas. Queensland, Div. Ent. Bul. 3 (1916), pp. 48, figs. 57*).—This is a brief record of field and other observations made of the insect enemies of sugar cane, largely in the vicinity of Gordonvale.

Revision of the Japanese termites, S. HOZAWA (*Jour. Col. Sci. Imp. Univ. Tokyo, 35 (1915), Art. 7, pp. 161, pls. 4, figs. 39*).—This revision, in which 13 species are recognized, includes a table showing their distribution in Japan and a list of the literature on the Japanese species, together with colored figures of most of the species.

Experiments on the transmission of infantile leishmaniasis by fleas (Pulex irritans), PEREIRA DA SILVA (*Arq. Inst. Bact. Camara Pestana, 4 (1916), No. 3, pp. 261–267*).—The author's investigations have led to the conclusion that thus far it has not been demonstrated that fleas (*Ctenocephalus canis* and *P. irritans*) act as agents in the transmission of human and canine leishmaniasis.

Native food plants and feeding habits of the cotton stainer in St. Vincent (*Agr. News [Barbados], 15 (1916), Nos. 369, pp. 202, 203; 370, p. 218*).—Investigations made of *Dysdercus delauneyi* in districts where Sea Island cotton is grown on an extensive scale show that at the end of February, when the fields are being cleaned of the old cotton plants, it migrates to trees, bushes, and herbaceous plants nearby. It feeds on flowers of the mango (*Mangifera indica*), *Eupatorium odoratum*, black sage (*Cordia cylindristachya*), and horse-radish tree (*Moringa pterygosperma*), the fruit of okra (*Hibiscus esculentus*) and maiden's blush (*Mormordica charantia*), and secretions of scale insects, but does not appear to be able to breed thereon. Its occurrence on two malvaceous food plants other than cotton, namely, the silk cotton tree (*Eriodendron anfractuosum*) and the John Bull tree (*Thespesia populnea*) which are its chief food plants in the close season for cultivated cotton, is considered at some length.

Additional notes on the native food plants and feeding habits of the cotton stainer in St. Vincent (*Agr. News [Barbados], 15 (1916), No. 373, p. 267*).—With further observations of *Dysdercus delauneyi*, an account of the food plants and feeding habits of which is above noted, the infestation of young cotton fields has been definitely traced to the silk cotton tree (*Eriodendron anfractuosum*) and the John Bull tree (*Thespesia populnea*). A campaign of control will consist at first in the destruction of the John Bull trees.

Key to the nearctic species of Paracalocoris (Heteroptera; Miridæ), W. L. MCATEE (*Ann. Ent. Soc. Amer., 9 (1916), No. 4, pp. 366–390*).—The key given to this genus of the subfamily Mirinæ includes 10 species of which 4 are new and 26 varieties of which 23 are new. Among the more important are *Paracalocoris scrupeus cunealis* n. var., occurring on wild apple, Cratægus, and quince at Batavia, N. Y., and *P. hawleyi ancora* n. sp. and n. var., reported by I. M. Hawley as becoming a pest of economic importance on the cultivated hop near Waterville, N. Y., where he has worked out its life history.

The leafhoppers or Jassoidea of Tennessee, D. M. DELONG (*Tenn. Bd. Ent. Bul. 17 (1916), pp. 113, figs. 24*).—This work, which includes keys to the families, genera, and species of leafhoppers occurring in Tennessee, lists and describes 212 species and varieties.

Observations on the ecology of Coccidæ, with special reference to their morphology and physiology, G. TEODORO (*Redia, 11 (1916), No. 1–2, pp. 129–209, pls. 3, figs. 3*).—This discussion includes a bibliography of 100 titles.

Researches and experiments in the control of Chrysomphalus dictyospermi of citrus in Sicily in 1914, G. DEL GUERCIO and E. MALENOTTI (*Redia, 11 (1916), No. 1–2, pp. 1–127, pl. 1, figs. 25*).—Though reporting largely upon control work with insecticides, the biology of the "bianca-rossa" is briefly considered.

Statistics on the production of silk in France and elsewhere (*Statistique de la Production de la Soie en France et a l'Étranger. Lyon: Syndicat de l'Union des Marchands de Soie de Lyon, 1916, pp. 78*).—Statistical data on silk production during 1914 in occidental Europe, the Levant and central Asia, and the extreme Orient are here presented. See also a previous note (E. S. R., 35, p. 56).

The white-marked tussock moth, R. L. WEBSTER (*Iowa Sta. Circ. 33 (1916), pp. 4, figs. 3*).—Numerous reports of the abundance of this pest in Iowa received during the fall of 1916 led to the preparation of this brief account.

The potato tuber moth, J. E. GRAF (*U. S. Dept. Agr. Bul. 427 (1917), pp. 56, pl. 1, figs. 45*).—This is a report of investigations of the potato tuber worm conducted in southern California from 1912 to 1916, a general account of which pest by Chittenden has been noted (E. S. R., 29, p. 855.)

This moth injures the potato by destroying the leaf surface and tunneling in the substance of the tuber. The tuber-feeding larva injures the potatoes themselves by tunneling through them, so filling these tunnels with excrement and fungus that the potatoes, even if not severely injured, are very unsightly and of small market value. It is a source of serious injury to other plants as well, including eggplant, tomato, red pepper, tobacco, etc.

The life history studies here reported upon at length show that in southern California there are five or six generations, all stages occurring at all times of the year. Parasites, while varying in effectiveness, play an important part in checking the pest, the egg and pupa each having its parasite, while several attack the partially grown larvæ and at least two the mature larvæ. Since the burrowing habit of the larva protects it from parasites, except while spinning its cocoon and pupating, it is doubtful if parasites can be of practical importance when the insect infects stored tubers. During 1914 *Habrobracon johanniseni* was the most effective parasite, their order of importance in that year being as follows: *H. johannseni, Chelonus shoshoneanorum, Sympiesis stigmatipennis, Campoplex phthorimææ, Bassus gibbosus, Apanteles* sp., *Microgaster* sp., *Nepeira benevola fuscifemora,* and *Zagrammosoma flavolineatum.* During 1915 *Dibrachys clisiocampæ, S. stigmatipennis,* and *C. phthorimææ* were of first and about equal importance. Observations of a secondary parasite, *D. boucheanus,* and the parasites above mentioned are recorded in connection with illustrations of each.

Data relating to control measures have been summarized as follows:

"The numbers of the insect should be reduced by practicing good farming and leaving no tubers exposed for the insect to work on. Potatoes should be harvested and marketed as rapidly as possible, unless the grower has facilities for storage and is prepared to treat the potatoes if necessary. Once the tubers become infested, the best way of ending the damage is to fumigate with carbon bisulphid, using 2 lbs. to 1,000 cu. ft. of air space (measured before storing the tubers) and allowing 48 hours for fumigation. Clean or uninfested potatoes should be kept away from the moth.

"Potatoes should never be left in the ground after they are ripe and where the soil is dry. When tubers are infested and facilities are lacking for storing

in bins, the progress of infestation can be checked by holding the potatoes in cold storage. The temperature should be about 37 to 40° F. This should be adopted only as a temporary method in keeping potatoes from deteriorating in value while they are being held for a rise in price."

A map showing the localities in which the potato moth is established on potato, localities in which it is established on other plants, and localities where it has been introduced but is not established is attached. A bibliography of 96 titles is included.

The rhododendron tingid (Stephanitis rhododendri) in Surrey, E. E. GREEN (*Ent. Mo. Mag., 3. ser., 2 (1916), No. 21, pp. 207, 208*).—The author records the occurrence of this pest at Camberley.

A note by G. C. Champion appended calls attention to the fact that *Leptobyrsa explanata*, described by Heidemann in 1908 as occurring abundantly on mountain laurel (*Kalmia latifolia*) and injuring the foliage of *Rhododendron maximum* along the Atlantic coast of the United States (E. S. R., 21, p. 451), is certainly the same species. An account of the life history of *L. explanata* by Crosby and Hadley has been previously noted (E. S. R., 34, p. 451).

Observations of the biology of Recurvaria nanella, A. MIGNONE (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 25 (1916), I, No. 3, pp. 188–195*).—This is a preliminary report of studies of the lesser bud moth in Italy. Studies of this pest by Houghton in England (E. S. R., 15, p. 787) and by Scott and Paine in the United States (E. S. R., 31, pp. 252, 755) have been previously noted.

Evolution of the color pattern in the microlepidopterous genus Lithocolletis, ANNETTE F. BRAUN (*Jour. Acad. Nat. Sci. Phila., 2. ser., 16 (1915), pp. 105–166, pls. 2, figs. 26*).—Among the species listed, in which the development of the pattern has been traced from the first appearance of color to the adult markings, *Lithocolletis cratægella* is of economic importance.

Neuropteroid insects of the Philippine Islands, N. BANKS (*Philippine Jour. Sci., Sect. D, 11 (1916), No. 3, pp. 195–217, pls. 2*).

The control of the house fly, R. BLANCHARD (*Ligue Sanit. Franç. Bul. 5 (1915), pp. 63, figs. 27; abs. in Jour. Roy. Army Med. Corps, 26 (1916), No. 2, pp. 248–254, figs. 3*).—A general discussion of the subject, of the more important species occurring in the house, their manner of reproduction, diseases transmitted, and control measures. A discussion by H. G. Richter of the manner of arranging manure heaps in order to destroy the fly larvæ contained therein is appended (pp. 59–62).

Prevention of fly breeding in horse manure, S. M. COPEMAN (*Lancet [London], 1916, I, No. 24, pp. 1182–1184, figs. 2*).—The author reports experiments with the "close-packing" method of controlling the house fly in horse manure about military camps.

It was found that the temperature developed during fermentation largely depended on the manner in which the manure was stacked during the building of the heap. In temperature experiments by F. M. Howlett maggots were found to be killed quickly by either dry or wet heat at any temperature above 114.8° F., and he considers it improbable that they could live long at any temperature above 106°. Records kept of temperatures in piles of manure showed that at no great depth from the surface the heat was too great to permit the existence of larvæ. On the top of the piles the larvæ were living only in the surface layers, and the excessive heat due to fermentation becomes practically a larvicide.

Some experiments on the house fly in relation to the farm manure heap, H. ELTRINGHAM (*Jour. Agr. Sci. [England], 7 (1916), No. 4, pp. 443–457, figs. 3*).—This is a report of a series of experiments conducted with a view to test-

ing the fly-breeding capacity of the open farm manure heap as distinguished from heaps in close proximity to dwellings. The conclusions drawn which apply to manure heaps far distant from houses are as follows:

While the house fly is liable to breed in large numbers in stable refuse which is stored in close proximity to dwellings, the governing factor is found in the dwellings rather than in the manure heap, the latter merely serving as a secondary convenience, providing a breeding place for the flies which have been attracted to the houses in search of food. The open farm manure heap far away from houses is but little frequented by house flies, and then only later in the season when the insect has become numerous and widely dispersed. The spent manure heap, in which fermentation has practically ceased, produces under rural conditions at least practically no flies at all. Although the farm heap may produce but few house flies, it is a prolific source of *Stomoxys calcitrans*, and those agriculturists who value the comfort and health of their animals should treat all manure with a view to the destruction of the larvæ of this pest.

A note on some helminthic diseases with special reference to the house fly as a natural carrier of the ova, T. O. Shircore (*Parasitology, 8 (1916), No. 3, pp. 239–243*).—The data presented show the house fly to be an important factor in the conveyance of the ova of helminths.

Filariasis.—Report of two cases in the District of Columbia and analysis of the cases reported for eastern North America, M. W. Lyon, Jr. (*Jour. Amer. Med. Assoc., 68 (1917), No. 2, pp. 118, 119*).—In reporting upon two cases of infection with *Filaria bancrofti* in the District of Columbia it is pointed out that *Culex quinquefasciatus*, the mosquito which serves as the intermediate host of *F. bancrofti*, ranges as far north as Washington and St. Louis, and perhaps farther.

A new enemy of maguey, G. Gandara (*Mem. y Rev. Soc. Cient. "Antonio Alzate," 32 (1915), No. 11–12, pp. 483–489, figs. 5*).—An account of (*Trypeta*) *Myennis scutellaris*, which is a source of injury to the agave in Mexico.

The cabbage root maggot and its control in Canada, with notes on the imported onion maggot and the seed-corn maggot, A. Gibson and R. C. Treherne (*Canada Dept. Agr., Ent. Branch Bul. 12 (1916), pp. 58, pl. 1, figs. 29*).—This bulletin reports studies of the biology of the cabbage maggot and of control measures made at Agassiz, British Columbia, and at Ottawa, Ontario. It records observations made of the depth of puparia in the soil, emergence of flies from puparia buried at different depths, the length of the puparium stage during summer and autumn, length of the life of individual flies, development, habits, and reproduction, and gives a chart which shows the egg deposition of the cabbage maggot at Agassiz in 1915, with records of prevailing temperature, rain, etc.

Short accounts of the life history, habits, and reproduction of the imported onion maggot or *Hylemyia antiqua* (*Phorbia cepetorum*) and of the seed-corn maggot (*P. fusciceps*) follow.

The means of controlling root maggots considered include the use of tar paper disks (E. S. R., 31, p. 352; 35, pp. 53, 55), cheesecloth frames (E. S. R., 25, p. 38), trap crops, etc. The bulletin concludes with a discussion of the control of root maggots under field conditions.

The parasites of maggots reared in Canada are a staphylinid (*Baryodma ontarionis*), long known in eastern Canada as an enemy of the cabbage root maggot; a cynipid (*Cothonaspis gillettei*), which has a wide distribution in the Dominion; a chalcidid (*Pachycrepoideus dubius*); and what is thought to be *Hemiteles ruficoxus*. The predators, which were found under laboratory conditions to readily devour the eggs, larvæ, and often the hard-shelled puparia,

are *Bembidium mutatum*, *B. trechiforme*, *Platynus cupreus*, *Pterostichus lucublandus*, and *Amara* (*Celia*) *farcta*. Other species recorded as probably predacious at Agassiz are *Orus punctatus*, *Xantholinus hamatus*, *Hesperobium californicum*, *Dinaræa angustula*, and a red mite.

Some experiments on the breeding of the mangold fly (Pegomyia hyoscyami) and the dock fly (P. bicolor), A. E. Cameron (*Bul. Ent. Research*, 7 (*1916*), *No. 1*, *pp. 87–92*, *figs. 2*).—The experiments here reported have led the author to the conclusion that "*P. hyoscyami* reared on belladonna will oviposit and complete its life history on mangolds if belladonna be absent. Why this same species did not oviposit on the leaves of sugar beet was not discovered. *P. hyoscyami* reared on mangold leaves did not oviposit on those of the very closely allied sugar beet. All that can be inferred from the experiment is that the species when reared on the leaves of the mangold will more readily oviposit on those of the same plant than on sugar beet.

"*P. bicolor* reared on dock does not oviposit and complete its life history on the leaves of the mangold or sugar beet. It may also be safely asserted that neither does *P. hyoscyami* reared on mangold or sugar-beet leaves oviposit on those of the dock.

"Where weeds and cultivated plants have their leaves similarly blotched and blistered by leaf-mining maggots, one must make a careful examination of the insects before stating that the damage is due to one and the same agent. The author believes that hasty and immature judgment has led to the commonly accepted error that the maggot (*P. bicolor*) which mines in the leaves of the dock also attacks those of mangolds. That the insect which blisters the leaves of the common weed, goosefoot (*Chenopodium album*), is identical with the *P. hyoscyami* which causes similar injury to mangold leaves, there is no doubt. In how far there may be a migration, if any, of the insects between the two plants has not been experimentally established."

An account of the life history of *P. hyoscyami* by the author has been previously noted (E. S. R., 32, p. 351).

A new species of Agromyza destructive to beans in the Philippines, J. R. Malloch (*Proc. Ent. Soc. Wash.*, *18* (*1916*), *No. 2*, *p. 93*).—*Agromyza destructor*, which is very destructive to beans in the Philippine Islands through working in the stems of young plants, is described as new.

The scarabeid enemies of sugar cane, C. Moreira (*Os Besouros da Canna de Assucar. Rio de Janeiro: Min. Agr., Indus., e Com., 1916*, *pp. 25*, *figs. 22*).—A brief account of the more important white grubs injuring sugar cane in Brazil and means for their control, with a note on other sugar cane pests.

On the value of poison bait for controlling cane grubs, E. Jarvis (*Bur. Sugar Expt. Stas. Queensland, Div. Ent. Bul. 4* (*1916*), *pp. 14*, *figs. 9*).—A report of laboratory tests of poison bait for the control of the grey-back cane beetle (*Lepidiota albohirta*), a serious pest of sugar cane.

A generic synopsis of the coccinellid larvæ in the United States National Museum, with a description of the larva of Hyperaspis binotata, A. Böving (*Proc. U. S. Nat. Mus.*, *51* (*1917*), *pp. 621–650*, *pls. 4*).—This paper includes a bibliography of ten pages.

A bad attack by the mustard beetle on water cress, A. Roebuck (*Jour. Bd. Agr.* [*London*], *23* (*1916*), *No. 3*, *pp. 238–241*, *pl. 1*).—*Phædon cochleariæ* has been the source of severe injury to water cress on a Shropshire farm.

The desert corn flea-beetle, V. L. Wildermuth (*U. S. Dept. Agr. Bul. 436* (*1917*), *pp. 21*, *pl. 1*, *figs. 7*).—This is a report of studies of the biology and methods of control of *Chætocnema ectypa* commenced in the Imperial Valley of California in 1910 and carried on during 1913, 1914, and 1915 at Tempe, Ariz.

This flea-beetle occurs in injurious numbers in the cultivated areas of the

Southwestern States on corn, milo maize, sugar cane, Sudan grass, wheat, barley, and alfalfa. The adult is a source of injury through feeding upon the top of the plant and the larvæ upon the roots.

"The eggs are deposited at or near the surface of the ground and hatch in about six days. The young larvæ are found within the tender roots of the food plants, while the older larvæ are found in the soil near these roots. The average length of the larval stage is found to be 32 days. The prepupal and pupal stages are both passed within a cell in the soil near to the roots on which the larvæ fed. The flea-beetles hibernate in the adult stage under rubbish or at the base of various grasses growing in the regions of infestation. The total length of the life cycle of this flea-beetle is about seven weeks, there being from three to four generations each year.

"The numbers of adult flea-beetles can be reduced greatly by cleaning up hibernation quarters and eradicating some of their weed food plants, such as Johnson grass, salt grass, and Bermuda grass. They can be further reduced by carefully cultivating such crops as can be cultivated just as soon as the soil becomes dry, following each irrigation. This method destroys a great many pupæ. Small pieces of corn can be sprayed successfully with arsenate of lead, using 2 lbs. to 50 gal. of water, the water being made into a strong soap solution. This acts both as a repellent and as a poison to the beetles. Injury to corn and other crops can be overcome partially if the soil is placed in the best possible cultural condition by the addition of barnyard manure or other fertilizer. The nymphs and adults of a predacious hemipteran (*Reduviolus ferus*) were observed to feed upon these beetles, and a small parasitic wasp, *Neurepyris* sp., was found to prey upon the larvæ and prepupæ."

Borers infesting the ash, F. J. SEAVER (*Jour. N. Y. Bot. Gard., 17 (1916), No. 199, pp. 95–97, pls. 2*).—A brief account of the life history of and injury caused by the ash borer (*Podosesia syringæ*), which is a close rival of the leopard moth in its destruction of the ash.

A new species of Pityogenes, J. M. SWAINE (*Syracuse Univ. [Pubs.], 16 (1915), No. 1, pp. 8–10*).—The species here described as new, *Pityogenes hopkinsi*, is the most abundant bark beetle in the limbs of pine throughout the eastern part of Canada and the United States. A second species is described as *P. lecontei* n. sp.

Observations on the life history and habits of Pityogenes hopkinsi, M. W. BLACKMAN (*Syracuse Univ. [Pubs.], 16 (1915), No. 1, pp. 11–66, pls. 6*).—The author here reports studies of the life history and bionomics of the species above described as new to science.

Thirty-sixth annual report of the Beekeepers' Association of the Province of Ontario, 1915 (*Ann. Rpt. Beekeepers' Assoc. Ontario, 1915, pp. 92, figs. 8*).—This report of the proceedings of the association includes papers on Temperature and Humidity in the Hive in Winter, by E. F. Phillips (pp. 10–27); Honey Production from the Golden-rods and Asters, by F. W. L. Sladen (pp. 27–30); Outdoor Wintering, by H. G. Sibbald (pp. 30–38); Notes from the Year's Work, 1915, by M. Pettit (pp. 38–46); etc.

Sacbrood, G. F. WHITE (*U. S. Dept. Agr. Bul. 431 (1917), pp. 54, pls. 4, figs. 33*).—This is a detailed report of investigations of an infectious disease of the brood of bees which is caused by a filterable virus, as described in the preliminary report previously noted (E. S. R., 29, p. 57).

The author has found that a colony can be inoculated by feeding it sirup or honey containing the virus, that the quantity of virus contained in a single larva recently dead of the disease is sufficient to produce quite a large amount of sacbrood in a colony, and that the incubation period is approximately six days, though frequently slightly less. While the disease is more often en-

countered during the first half of the brood-rearing season than during the second half, it may be produced by inoculation at any season of the year that brood is being reared. "It occurs among bees in localities having as wide a range of climatic conditions, at least, as are found in the United States. The course of the disease is not greatly affected by the character or quantity of the food obtained and used by the bees. Larval remains recently dead of the disease prove to be very infectious when fed to bees. Dead larvæ which have been in the brood comb more than one month are apparently noninfectious. Colonies possess a strong tendency to recover from the disease without treatment.

"The virus of sacbrood suspended in water and heated to 138° F. (59° C.) was destroyed in 10 minutes. Considering the varying factors which enter into the problem, the minimum temperature necessary to destroy this virus when applied for 10 minutes should be found at all times to lie somewhere between the limits of 131 and 149° F. When the virus of sacbrood is suspended in honey it may be destroyed by heating the suspension for 10 minutes at approximately 158°."

The virus resisted drying at room temperature for approximately three weeks. It was destroyed by the direct rays of the sun in from four to seven hours when dry, when suspended in water in from four to six hours, and when suspended in honey in from five to six hours. When suspended in honey and shielded from direct sunlight it remained virulent for slightly less than one month at room temperature during the summer. The virus was destroyed in approximately five days in the presence of fermentative processes taking place in 10 per cent sugar solution at room temperature.

"In the presence of fermentative processes going on in 20 per cent honey solution at outdoor temperature the virus of sacbrood was destroyed in approximately five days. In the presence of putrefactive processes the virus remained virulent for approximately 10 days. The virus will resist 0.5 per cent, 1 per cent, and 2 per cent aqueous solutions of carbolic acid, respectively, for more than three weeks, 4 per cent being more effective. Neither carbolic acid nor quinin as drugs should at present be relied upon in the treatment of sacbrood.

"Varying factors entering into many of the problems discussed in this paper tend to vary the results obtained. In such problems the results here given must be considered from a technical point of view as being approximate only. They are sufficiently exact for application by the beekeeper, but to insure the destruction of the virus in practical apiculture the time element indicated from these experiments as sufficient should be increased somewhat."

Descriptions of seven new species of red spiders, E. A. McGregor (*Proc. U. S. Nat. Mus., 51 (1917), pp. 581–590, pls. 7*).—Six species of Tetranychus and one of Tetranychina are here described as new to science. Of the former, two are from South America and four from North America. *Tetranychus ilicus* discolors the leaves of American holly, *T. willamettei* injures at times the appearance of the western white oak, and *T. monticolus* saps the vitality of the large huckleberry of the Cascade region.

A case of infestation with Dipylidium caninum, Maria P. Mendoza-Guazon (*Philippine Jour. Sci., Sect. B, 11 (1916), No. 1, pp. 19–31, figs. 3*).—The author records the finding of this canine tapeworm in an infant.

FOODS—HUMAN NUTRITION.

Studies on the digestibility of the grain sorghums, C. F. Langworthy and A. D. Holmes (*U. S. Dept. Agr. Bul. 470 (1916), pp. 31*).—This bulletin reports data regarding the digestibility of the grain sorghums, dwarf kafir corn,

feterita, dwarf milo maize, and kaoliang, obtained by feeding these to seven normal young men. The grains were ground to a meal and eaten either in the form of bread, with a basal ration of potato, apple sauce, butter, and sugar, or as a mush, with a basal ration of apple sauce, butter, sugar, and sirup. For comparison similar experiments were made with breads prepared from corn and wheat meals. The results of these experiments may be summarized briefly as follows:

When the kafir corn was eaten in the form of hard bread, 58 per cent of its protein was digested. This value may be high owing to the large proportion of milk protein in the diet. When eaten in the form of a softer bread the average digestibility of the protein of the dwarf kafir corn was 51 per cent, of the feterita 51 per cent, of the dwarf milo maize 40 per cent, and of the kaoliang 20 per cent. When eaten as a mush the percentage digestibility of the protein of the dwarf kafir corn was 48 per cent, of the feterita 48 per cent, of the dwarf milo maize 34 per cent, and of the kaoliang 4 per cent. No attempt was made to estimate the digestibility of the fat as supplied by cereals since it was present in very small quantity.

The carbohydrates of the experimental ration and of the sorghums alone were found to be very completely utilized.

"Considering the grain only, as distinguished from the ration as a whole, the average value for the kafir corn (hard) bread was 98 per cent, for softer dwarf kafir corn bread 96 per cent, and for dwarf kafir corn mush 96 per cent. In the case of carbohydrates supplied by feterita, the average values were 97 per cent for the bread and 99 per cent for the mush; with dwarf milo maize 96 per cent for the bread and 98 per cent for the mush; and for kaoliang 96 per cent for both bread and mush."

The corn and wheat proteins were found to be somewhat less thoroughly digested than is usually the case, this being due probably to the coarseness of the meals used. The average digestibility of the corn bread protein was 60 per cent and of the coarse wheat bread protein 77 per cent. As the experiments with all the grains were conducted under uniform conditions it is concluded that the protein of the grain sorghums is less digestible than that contained in either corn or wheat.

These experiments and information available regarding the preparation of the sorghums for the table indicate that these grains are valuable as human food. In cooking, care must be taken that they absorb a sufficient quantity of water so that the particles of meal which are characteristically hard may be well softened. The flavor of the grain sorghums is generally agreeable. Although their protein is less completely assimilated than that of corn or wheat, they are, with the exception of kaoliang, fairly good sources of this food constituent. In addition, they are a good source of carbohydrate, which they furnish in a form very completely available to the body.

On the digestibility of bread.—II, Salivary digestion of erythrodextrin in vitro, J. C. Blake (*Jour. Amer. Chem. Soc.*, *39* (*1917*), *No. 2*, *pp. 315–320*, *figs. 2*).—Further data are reported upon one phase of the experiments reported in the first article of this series (E. S. R., 35, p. 468), namely, the effect of moderate variations in concentration upon the activity of the amylases studied. The following conclusions are drawn:

"The digestion of erythrodextrin by ptyalin is a monomolecular reaction. The optimum temperature for this digestion is 51° C. (91.8° F.). The temperature coefficient is relatively small at the ordinary temperature, being about the same as that of chemical reactions in general. The enzym is destroyed at 65°. The digestion becomes disproportionately slow when the ratio of substrate to enzym becomes very large. This ratio is constant for different

concentrations, and probably represents a compound formed by the union of the enzym and the substrate preliminary to hydrolysis. The retarding influence of maltose is shown to be relatively small and to vary directly as its concentration. The relatively slow digestion of achroödextrin is again pointed out, and a preliminary redetermination of its specific rotation made."

Food supply orders [milling of flour] (*Bd. Trade Jour.* [*London*], *95* (*1916*), *No. 1043, pp. 570, 571*).—Note is made of the percentages of flour which must be obtained from wheats of various qualities, according to an order of the British Government.

Government control over flour, W. Jago (*Nature* [*London*], *98* (*1916*), *No. 2457, pp. 250, 251*).—This article discusses the flour-milling order noted above, especially with regard to the quality of the bread and flour produced and the question of increasing the percentage of flour obtainable from the wheat.

Flour standards, W. Jago (*Nature* [*London*], *98* (*1917*), *No. 2464, p. 390*).—In increasing beyond a certain point the percentage of flour from a given amount of wheat the author advocates the addition of flour derived from barley, maize, rice, or oats, rather than the addition of wheat offal. While the flours from barley and the other cereals mentioned show an absence of gluten, they do not contain the proteolytic and starch-converting enzyms present in the whiter portion of the wheat offal, which acts diversely on the gluten and starch of the flour.

Trichinæ in pork and nematodes in butterfish in their relation to the implied warranty in the sale of articles of food, C. W. Stiles (*Jour. Amer. Med. Assoc.*, *68* (*1917*), *No. 9, pp. 685–687*).—The author states that from the standpoint of the zoologist the term "diseased" in the sense of the food laws should be interpreted differently from its academic meaning, and that the terms "diseased meat" and "meat from diseased animals" really mean meat which is likely to produce disease when eaten by human beings. In discussing the question of implied warranty on the part of the food vendor, on the basis of this interpretation of the term diseased meat, he maintains that there is justification for the vendor of live shellfish, chickens, fish, or other raw foods to assume that the purchaser of these foods is under an implied guaranty to see that they will be properly handled and prepared for reception into the stomach before they are served as food. In discussing the sale of raw pork attention is called to the facts that the absence of live trichinæ in fresh pork can not be guarantied by any known practical method of inspection and that if the pork is properly cooked any trichinæ present are killed and hence can not produce disease.

With reference to the nematodes which were found in some samples of butterfish, the author states that these fish should not be considered as diseased in the above sense, since the encysted worms were present chiefly on the entrails and if properly dressed and cooked the fish would not be liable to produce disease in man, although from the standpoint of the fish themselves they were undoubtedly diseased.

[Analyses of] baking powder, A. McGill (*Lab. Inland Rev. Dept. Canada Bul. 360* (*1917*), *pp. 25*).—Analytical data are given regarding 213 samples of commercial baking powders.

Annual report 1916 Food and Drug Department State of Tennessee, H. L. Eskew (*Ann. Rpt. Food and Drug Dept. Tenn.*, *1916*, *pp. 22*).—The activities of the department during the year 1916 consisted in the inspection of hotels, the testing of weights and measures, and the examination of 1,358 samples of miscellaneous foods, drugs, and beverages.

State laws and regulations pertaining to public health adopted during the year 1915 (*Pub. Health Rpts.* [*U. S.*], *Reprint 338* (*1915–16*), *pp. XIX+612*).—Many of the laws included in this compilation relate to foodstuffs.

Twentieth annual convention of the Association of American Dairy, Food, and Drug Officials, held at Detroit, Michigan (*Proc. Assoc. Amer. Dairy, Food, and Drug Officials, 20* (*1916*), *pp. 239, fig. 1*).—The proceedings are reported of the meetings held at Detroit, Mich., August 7–11, 1916.

The following papers were among those read: Malnutrition through Errors in the Combination of Foods, by E. V. McCollum; Demonstration of Simple Steam Sterilizer for Farm and Dairy Utensils, by G. B. Taylor; Inspection of Grocery Stores and Markets, by H. C. Smith; Skim Milk as a Human Food, by J. P. Street; Laboratory Control of Food Industry, by H. E. Barnard; Contribution to Knowledge of Chemical Composition of Fruit Extracts, by W. S. Long; Relation of Composition to Quality of Cheese, by J. N. Currie; Inspection of Canned Foods, by W. D. Bigelow; and Sanitation in Food Control, by G. G. Frary.

The reports of committees are included. As a part of the report of the committee to assemble current literature on the subject of nutritional disorders, the result of so-called devitalized foods, there is included an extensive bibliography of nutritional deficiency diseases, prepared by S. J. Crumbine.

Food values—what they are, and how to calculate them, Margaret McKillop (*London: George Routledge & Sons. Ltd.; New York: E. P. Dutton & Co., 1916, pp. VIII+136*).—This book brings together a great deal of information regarding the value of different kinds of foods in the diet and the nutritive requirements of men, women, and children. Tables are given which show the chemical composition and fuel value of a large number of different foods. A chapter is devoted to the use of these tables in determining the proportion of different food constituents furnished by made dishes, daily diets, and weekly menus, and another to miscellaneous calculations.

Food values, R. Harcourt (*Ontario Dept. Agr. Bul. 245* (*1916*), *pp. 14*).—This bulletin contains data regarding the economic selection of different foods and some information on bread making.

Food supplies and prices in war time, with special reference to imports (*Jour. Bd. Agr.* [*London*], *23* (*1917, No. 10, pp. 955–965*).—A compilation of statistical data regarding the supplies of meat, dairy products, cereals, fruits, and vegetables.

War food societies (*Jour. Bd. Agr.* [*London*], *23* (*1917*), *No. 10, pp. 965–969*).—Information is given regarding the activities of different societies having for their object the increase and economic use of the food supply.

[Diet in the Kansas State Penitentiary], J. E. Caton in (*Official Report by State Accountant Relating to the State Penitentiary. Topeka, Kans.: State, 1916, pp. 11–14*).—This report contains several recommendations made by E. H. S. Bailey and others by L. A. Congdon regarding the food furnished the inmates of the prison.

Some interrelations between diet, growth, and the chemical composition of the body, L. B. Mendel and Sarah E. Judson (*Proc. Nat. Acad. Sci., 2* (*1916*), *No. 12, pp. 692–694*).—The results are reported of 88 analyses of the entire body of the white mouse at different stages of growth.

It was found that the ash content of mice growing normally on an artificial food mixture of milk powder, casein, starch, salts, and butter fat was uniformly higher at the corresponding stages of growth than the ash content of mice fed a ration of mixed grain, dog bread, and small amounts of milk. When the diet contained an abundance of fat but not enough protein to maintain normal growth the fat content of the animal was found to be greater than

when the food contained adequate protein with the same proportion of fat. By underfeeding gain in weight was arrested and constant weight maintained for 30 and 60 days. Comparison of the composition of these stunted mice with that of mice growing normally showed that "the proportion of fat in the stunted animal is about the same as in the normal mouse of the same weight (but younger), while the percentage of water in the fat-free substance corresponds to the water content of a normal mouse of the same age (but heavier)." The ash content of the stunted mice was greater than that of the normal mice of the same weight.

Retardation of growth by reduction of protein or salts in the food or by substitution of gliadin for other proteins affected the ash content of the animal in the same way as did underfeeding. Young mice maintained for a time at constant weight when given sufficient food again grew at a greatly accelerated rate, which enabled them to overtake control mice which had grown uninterruptedly. The ash content, however, did not increase at the same rate and the development of the skeleton did not, in the active growth which accompanied refeeding, keep pace with the rapid gain in body weight, so that in a few days the normal relation was almost reestablished.

Ammonia and amino acids in the stomach and intestinal content with exclusively vegetable diet, G. Agnoletti (*Arch. Farmacol. Sper. e Sci. Aff., 22 (1916), No. 7, pp. 261–273*).—From observations on animals (horses and asses) the following conclusions were drawn:

A part of the nitrogenous portion of the soluble fraction of the stomach content not found as total nitrogen was present in the form of ammonia, and a much greater part in the form of amino acids. The quantities of ammonia nitrogen and nitrogen titratable as formol found in the intestine exceeded the quantities found in the stomach. In general with each group of animals receiving the same food (hay, Indian corn, and oats) a high percentage of amino acids in the intestinal content corresponded to a high percentage of amino acids in the soluble portion of the stomach content.

The influence of milk and carbohydrate feeding on the character of the intestinal flora.—IV, Diet versus bacterial implantation, T. G. Hull and L. Rettger (*Jour. Bact., 2 (1917), No. 1, pp. 47–71*).—The experiments here reported were made with laboratory animals (white rats) and are a continuation of earlier experiments (E. S. R., 33, p. 460). These were supplemented also by experiments with other laboratory animals and men. The following conclusions are drawn in part from the data presented:

Bacillus acidophilus (Moro) and *B. bifidus* (Tissier) are common inhabitants of the intestinal tract of the white rat and of man, sometimes being present in small numbers and at other times excluding all other forms, at least for short periods. "The typical flora of infants which subsist on mothers' milk is a good illustration of the extent to which one intestinal organism (*B. bifidus*) may dominate and even supplant all other types. The most important factor in determining the character of the flora is the diet.

"Lactose, milk, and mixed grains (wheat, oats, etc.) are specific articles of diet which exert an influence on the intestinal bacteria. Lactose, when fed in sufficient quantities (2 or 3 gm. daily), brings about a complete transformation of the flora of white rats within two or three days; milk requires a longer time, and does not bring about a complete change. Milk and lactose together form the most practical and effective diet, at least for man. Grain feeds tend to increase the number of aciduric bacteria, but their influence is comparatively small.

"Milk undoubtedly owes its beneficial action to the lactose, which constitutes almost half of the solid matter present. The explanation of this action must lie in the fact that the lactose is absorbed slowly from the intestine. On several

occasions it has been found in the feces of rats that had been supplied with it as a part of their diet. The raw grains are also probably acted upon slowly, or at least some of the intermediate carbohydrate products are not immediately absorbed. Bread, on the other hand, which contains cooked starch, does not foster the development of the aciduric bacteria, because it is digested quickly, and no available sugar remains in the intestine long enough to be attacked and utilized by this group of bacteria. . . .

"Meat or other high protein diet increases the indol-producing bacteria and other organisms of the so-called 'putrefactive' type, like *B coli* and *B. welchii;* cornstarch appears to foster the amylolytic group of intestinal organisms, while in a few experiments grain feed seemed to favor the development of what appeared to be fusiform bacilli.

"The reaction of the intestine remained independent of the character of the intestinal flora. While the acidity of the intestinal conents varied in different rats, it was not increased during the course of lactose feeding experiments. The acidity was highest in the duodenum, as a rule, and lowest at the ileo-cecal valve.

The marked influence of a high lactose diet upon the intestinal flora of man, which was demonstrated in these experiments, has been confirmed by other investigators working with typhoid patients, who found that eating milk sugar (250 to 300 gm. daily) brought about a marked change in the intestinal flora where the initial flora had been of a distinctly putrefactive type. The authors state that in both the earlier and present work they were unable to establish *B. bulgaricus* in the intestine of white rats even for short periods of time, although the bacilli were fed in large numbers. These results are in harmony with those of other investigators.

A bibliography of cited literature is appended.

Experimental studies of the intestinal flora, W. R. Sisson (*Amer. Jour. Diseases Children, 13 (1917), No. 2, pp. 117–127*).—Experiments are reported in which was studied the effect of various foods commonly used in infant feeding on the bacterial flora of the intestinal tract. The observations were made on infants and laboratory animals (puppies). The bacterial flora of the puppies fed on cow's milk was found to be essentially the same as that of infants on a similar diet. The following conclusions were drawn from the experiments with puppies:

"In puppies the types of organisms occurring at the duodenum, ileum, cecum, and rectum are in all instances similar. One can not speak of a characteristic local flora occurring in these regions.

"Feedings to puppies of cow's milk mixtures with high percentage of sucrose or lactose does not cause characteristic changes in the intestinal flora at any level, even when a diarrhea is produced.

"Starvation of 24 hours renders a relative amicrobism of the small intestine."

The influence of fresh and autoclaved cows' milk on the development of neuritis in animals, R. B. Gibson and Isabelo Concepcion (*Philippine Jour. Sci. Sect. B, 11 (1916), No. 3, pp. 119–133, pls. 2, figs. 2*).—Feeding experiments are reported with laboratory animals (fowls, pigs, and dogs). These were carried out to determine whether or not antineuritic substances were present in milk and to what extent these would be affected by autoclaving the milk for two hours at 125° C.

The results obtained showed the antineuritic vitamins to be present in milk in slight amounts only, and that the continued feeding of either fresh or autoclaved milk without suitable additions to the diet induced symptoms of beriberi. The authors state that the antineuritic powers of milk are so slight that in infant feeding the diet should be extended as soon as possible, and that

the young of healthy mothers are probably born with a reserve supply of the so-called vitamin substances sufficient to maintain them in good nutritive condition until the time when they begin to eat other foodstuffs. No evidence was obtained in these experiments that autoclaving the milk for two hours at 125° C. in any way affected its nutritive value.

ANIMAL PRODUCTION.

The feeding of animals, W. H. JORDAN (*New York: The Macmillan Co., 1917, rev. ed., pp. XVII+473, pls. 8, figs. 17*).—This is a new and revised edition of the work previously noted (E. S. R., 13, p. 880). The recent advances in the subject of animal feeding with respect to growth and maintenance under various conditions, together with the results of recent investigations on growth-promoting substances, have been included.

The relative value of certain proteins and protein concentrates as supplements to corn gluten, T. B. OSBORNE, L. B. MENDEL, ET AL. (*Jour. Biol. Chem., 29 (1917), No. 1, pp. 69–92, fig. 1*).—In this paper the authors present data regarding the growth of laboratory animals (rats) which throw light upon the relative nutritive value of a number of proteins and protein concentrates when used to supplement corn gluten in an otherwise adequate ration. The substances studied included casein, lactalbumin, edestin, cottonseed protein, cottonseed flour, soy-bean flour, "milk albumin," beef tissue, fish-meat meal, corn-oil cake, "vegetable-albumin flour," brewers' grains, distillers' grains, pea meal, and peanut meal.

The results of the experiments indicate that "such food mixtures of approximately the same nitrogen and calorific content vary greatly in their efficiency for promoting growth, in accordance with both the character and the proportion of the protein supplement employed. The efficiency of these supplements presumably depends essentially upon their relative content of lysin and tryptophan; for the addition of these amino acids, either as such or in the form of proteins yielding them, renders corn gluten suitable for growth.

"Of the various proteins employed to supplement the inefficient corn gluten, lactalbumin is by far the most effective. Satisfactory growth is produced with smaller quantities of this protein than of any of the others recorded. The samples of brewers' grains, distillers' grains, and 'vegetable-albumin flour' used were the least efficient supplements tested, presumably because of their low content of lysin.

"It is evident that the small additions of the more efficient proteins actually supplement the corn gluten instead of themselves furnishing all of the protein used for growth, because equivalent amounts of these proteins alone in a similar ration are incapable of inducing a comparable degree of growth. Small amounts of a superior protein are often just as efficient for growth as larger amounts of a less adequate protein."

The authors state that the plan of feeding here described affords a practical method for studying accurately the comparative nutritive value of the nitrogenous components of commercial feeding stuffs.

[Bacteriological examination of feeding stuffs] (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. en Meded. Dir. Landb., No. 5 (1916), pp. 12, 13*).—The bacteriological examination of feeding stuffs as a control of soundness and freshness is noted. Normal samples were found to contain from 5,000,000 to 10,000,000 organisms per gram, while spoiled samples showed as high a content as 50,000,000 bacteria per gram of sample. The acidity of linseed cake was found to run parallel with the number of micro-organisms and also the degree of rancidity.

Inspection of commercial feed stuffs, P. H. Smith et al. (*Massachusetts Sta. Control Ser. Bul. 5 (1916), pp. 4–69*).—Brief comments are made upon the results of feeding stuffs inspection in the State during the year ended September 1, 1916, and the results are given of the analyses of cottonseed meal, linseed meal, corn oil cake, coconut meal, peanut meal, gluten meal, gluten feed, distillers' dried grains, malt sprouts, brewers' dried grains, yeast and vinegar grains, red dog flour, wheat middlings, wheat bran, corn meal, corn bran, hominy meal, dried beet pulp, buckwheat bran, meat scrap, beef scrap, digester tankage, bone meal, fish scrap, fish meal, clover meal, alfalfa meal, and mixed and proprietary feeds.

A brief article on the net weights of feeding stuffs is appended, together with tabulated wholesale cost data of feeding stuffs for the year.

Condimental stock foods and proprietary remedies, W. G. Gaessler (*Iowa Sta. Circ. 31 (1916), pp. 2–4*).—Advice is given against the indiscriminate purchase and use of condimental stock foods and tonics.

The breeding of animals, F. B. Mumford (*New York: The Macmillan Co., 1917, pp. XVII+310, pls. 32, figs. 17*).—In this manual for students and breeders of animals the author discusses the principles of genetics as they apply to the practice of animal breeding in accordance with the conclusions of biologists. Emphasis is placed upon those principles and practices that belong peculiarly to the province of the animal breeder, while not neglecting the lessons and illustrations to be drawn from the field of plant breeding.

The maintenance of breeding ewes of mutton and wool sheep, B. O. Severson (*Pennsylvania Sta. Bul. 144 (1916), pp. 3–20, figs. 6*).—This bulletin is a summary of experiments upon the maintenance of breeding Shropshire and Delaine-Merino ewes begun at the station in 1911. The results secured during 1911–1913 have already been noted (E. S. R., 34, p. 171; 35, p. 565).

During the winter periods 1913 to 1916 the sheep used were a few of the ewes remaining from the former tests and some of their offspring. The Shropshire pens, lots 1 and 2, consisted of 8 ewes each in the winter of 1913–14 and 10 ewes each in the winters of 1914–15 and 1915–16. The Delaine-Merino pens, lots 3 and 4, consisted of 6 ewes each in the winters of 1913–14 and 1914–15 and 8 ewes each in the winter of 1915–16. During the three winters 1913 to 1916 the different lots received the same grain mixture as the corresponding lots during the earlier period except that no cottonseed meal was fed. The roughage consisted of alfalfa hay for lots 1 and 3 and corn silage and alfalfa hay for lots 2 and 4. For lots 2 and 4 the alfalfa hay was limited to 2 lbs. per head daily for lot 2 and to 1.75 lbs. for lot 4 in 1915–16, and the silage to 2 lbs. per ewe daily in 1913–14. In 1914–15 the grain mixture was not fed previous to lambing and only to ewes that yeaned. During the summers the ewes were alternated on two pastures every two weeks. They flocked together without any grain except for a few weeks prior to and during the breeding season.

The average annual cost of maintenance of these ewes from December, 1913, to May, 1916, including interest, depreciation, and mortality risk, with alfalfa hay at $15 per ton, was $9 for lot 1, $7.59 for lot 2, $8.29 for lot 3, and $7 for lot 4. The average percentages of lambs by the ewes that yeaned were 195, 163, 115, and 126, and the percentages of lambs raised by ewes that yeaned were 110, 95, 95, and 100, respectively, for the four lots during the three years. The average weight of the lambs at weaning time for the four lots was 58.78, 59, 57.6, and 53.1 pounds, respectively. The average weight of fleece per ewe was 8.56 lbs. for lot 1, 7.66 for lot 2, 12.3 for lot 3, and 11.13 for lot 4. The average loss in weight per ewe during the three winter periods was 23.72 lbs. for lot 1, 19.87 for lot 2, 9.38 for lot 3, and 6.63 for lot 4. During the

summers of 1914 and 1915 the average gain in weight per ewe was 37.2 lbs. for lot 1, 33.52 for lot 2, 23.91 for lot 3, and 26.45 for lot 4.

It is concluded that "alfalfa hay at $15 per ton is too expensive as a sole roughage for breeding ewes of these types. Alfalfa hay with a grain mixture of 0.25 lb. per ewe daily produces vigorous lambs, results in a greater growth of wool, and stimulates a greater milk flow than a ration of corn silage, alfalfa hay, and grain. When alfalfa hay is fed without grain to breeding ewes prior to lambing the lambs are weak at birth and the ewes give less milk than with grain. . . . A ration of alfalfa hay, corn silage, and a limited grain mixture is more economical by 15.6 per cent than alfalfa as a sole roughage, and is satisfactory for pregnant ewes.

"Ewes fed no grain prior to lambing produced stronger lambs and gave more milk [when silage supplemented alfalfa hay]. Except for the 1915 crop of lambs, when no grain was fed prior to lambing, the lambs of lots 1 and 3, fed alfalfa hay as a sole roughage, carried a higher condition of flesh and made more rapid gains than those in lots 2 and 4, respectively. . . . A greater amount of manure was produced by ewes fed alfalfa hay as a sole roughage. . . .

"The lambs produced by the Delaine-Merinos were heavier at birth than the Shropshire lambs, due to a small proportion of twins. The Delaine-Merino lambs were hardier at birth and the ewes required less care than did the Shropshires. The cost of maintenance per ewe decreases with the increase in number of ewes in a flock to a unit of at least 40 ewes. . . . Shropshire lambs are worth from 50 to 75 cts. more per 100 lbs. live weight than Delaine-Merino lambs. . . .

"A high percentage of good market lambs is the most important factor in profitable sheep raising. Exercise and care of breeding ewes are as important as feeds in increasing the percentage of lambs. . . . Feed racks which prevent seed and chaff from getting into the fleece increase the value of wool from 1 to 2 cts. per pound."

Of the average income that was realized from the four lots during the last three years of the experiments when 100 per cent lambs were raised, 65.6 per cent was for mutton and 34.4 per cent for wool.

Poultry breeding and management, J. Dryden (*New York: Orange Judd Co., 1917, pp. XIV+402, figs. 188*).—This book, which contains a large number of illustrations and is of special interest to students of poultry culture and to poultry farmers, treats of the subject under the following chapter headings: Historical aspect, evolution of modern fowl, modern development of the industry, classification of breeds, origin and description of breeds, principles of poultry breeding, problem of higher fecundity, systems of poultry farming, housing of poultry, kind of house to build, fundamentals of feeding, common poultry foods, methods of feeding, methods of hatching chickens, artificial brooding, marketing eggs and poultry, and diseases and parasites of fowls.

The behavior of chickens fed rations restricted to the cereal grains, E. B. Hart, J. G. Halpin, and E. V. McCollum (*Jour. Biol. Chem., 29 (1917), No. 1, pp. 57–67, pl. 1*).—The experiments reported in this paper include observations extending through two years.

It was found that chickens started at half the normal weight could make slow growth, maintain themselves, and produce fertile eggs on rations limited to corn meal, gluten feed, and calcium carbonate, or wheat meal, wheat gluten, and calcium carbonate. These results are in marked contrast to those with swine or rats where these rations resulted in loss of weight and cessation of œstrum, and with wheat to a condition resembling polyneuritis.

"It is apparent that the mineral requirements at least, and possibly the requirements for the other normal nutritive factors, are not the same for chickens

as they are for mammals. Further, the chicken's ability to tolerate, without disaster and without modification of the ration, the toxic material of wheat speaks for a metabolism distinct from that of swine or rats.

"Where half-grown chickens were used there was no important improvement in the rates of growth or egg-lying capacity by supplementing the grains with either salts, casein, or butter fat, or a combination of the three, as contrasted with the results secured with the grain, grain protein concentrate, and calcium carbonate ration. The protein level in all cases was approximately 12 per cent. On all of these rations the number of eggs produced, although fertile, was limited. This fact, at variance with the best results of practice where animal protein concentrates have proved of great value as supplements to cereal grains for a large egg production, would suggest that either the higher plane—20 to 25 per cent—of protein intake of superior quality secured in practice by the use of the animal protein concentrates (meat scraps, milk, etc.) explains these differences, or else the latter contribute certain factors necessary for large egg production which the cereal grain concentrates or casein fail to carry. The matter needs further investigation."

Winter egg production, A. R. LEE (*U. S. Dept. Agr., Office Sec. Circ. 71 (1917), pp. 4*).—Suggestions are given for the stimulation of winter egg production in pullets and to some extent in hens by proper methods of feeding, housing, and handling.

DAIRY FARMING—DAIRYING.

The influence of the plane of nutrition of the cow upon the composition and properties of milk and butter fat: The influence of underfeeding, C. H. ECKLES and L. S. PALMER (*Missouri Sta. Research Bul. 25 (1916), pp. 3–107, figs. 15*).—The investigations reported in this bulletin are in continuation of those already noted (E. S. R., 35, p. 774).

In these experiments three pure-bred Jersey, one pure-bred Holstein, one pure-bred dairy Shorthorn, and two pure-bred Ayrshire cows were used. Sixteen experimental feeding periods were carried out with these cows, six of which were begun immediately after parturition, four within 30 days after parturition, and six somewhat later in the lactation period. In addition five experimental periods with the above cows, involving the reduction of a supernormal plane of nutrition, and seven experimental periods with cows other than the above, involving physiological underfeeding, are discussed.

The three types of underfeeding considered are those in which (1) the plane of nutrition of the cow is reduced to subnormal, (2) the plane of nutrition is reduced but not to subnormal, and (3) the cow is unable for physiological reasons to consume sufficient food to support the milk flow immediately after parturition. Of the factors which influence the effects of underfeeding on the composition and properties of milk and butter attention is given to (1) the stage of lactation period of the cow, (2) the degree of underfeeding, (3) the character of the ration, (4) the state of flesh of the cow, (5) the plane of nutrition of the animal previous to underfeeding, and (6) the length of the underfeeding period.

Data connected with the experiments are tabulated and shown graphically in the appendix. The following conclusions are drawn:

"A subnormal plane of nutrition causes a cow in lactation to lose more or less weight, depending on the state of flesh of the animal, the degree of underfeeding, and the length of time the animal is underfed.

"The effects of a subnormal plane of nutrition on the milk flow depend upon the stage of the lactation period at the time of underfeeding. Cows subjected

to a subnormal plane of nutrition immediately after parturition maintain their milk flow at a nearly constant level under the most adverse conditions. In one experiment a constant flow was maintained for 30 days with sufficient food for body maintenance only. A decline in milk flow accompanies even moderate underfeeding when the lactation period has reached a certain stage. The exact point when this occurs was not determined in the experiments. The explanation of this difference in the effect on the milk flow is believed by the authors to rest on the conception that the milk flow of the cow is stimulated by two factors, (1) chemical, (2) nervous. The former is more or less independent of the food supply and predominates for a period of time after parturition. The latter is almost entirely dependent on the food supply and predominates, or replaces the chemical stimulus, after the lactation period has attained a certain stage.

"Physiological underfeeding and reduction in the plane of nutrition from a high to a normal plane is invariably accompanied by a marked increase in the percentage of fat in the milk, especially when the cow has a surplus store of fat on her body. In the case of physiological underfeeding there is almost invariably an actual increase in the yield of milk fat, as well as in the percentage in the milk [E. S. R., 27, p. 280]. The effects of an induced subnormal plane of nutrition on the percentage and yield of fat in the milk are variable, an increased fat percentage sometimes resulting, in other cases there being no change, while in others an actual decrease in the percentage of fat results. The factors that appear to cause these variations are the state of flesh of the animal, the degree of underfeeding, and the season of the year in which the experiment is conducted.

"A subnormal plane of nutrition at times affects the percentage of protein in the milk. In some of the experiments conducted there was a decline in the percentage of casein, while in others the total protein only was affected. In the latter cases the percentage of ash in the milk also decreased. None of the types of underfeeding influenced the percentage of lactose in the milk.

"All types of underfeeding have marked effects on the physical and chemical constants of the butter fat, which are characterized by a decline in the Reichert-Meissl number and saponification value and an increase in the iodin value. Three types of results were noted with respect to the effects on the melting point of the butter fat, (1) increase in melting point, (2) stationary melting point, and (3) decrease in melting point. These differences are explained by the facts that in the group of experiments with increased melting point the decline in the volatile fatty acids was relatively greater than the increase in the oleic acid. In the group of experiments with constant melting point, the changes in the two kinds of fat constituents offset each other with respect to their effects on the melting point. In the group in which the melting point declined, the increase in oleic acid was relatively much greater than the decline of the volatile fatty acids.

"The proportion of volatile fatty acids in butter fat has a much greater influence on the melting point than the proportion of oleic acid. This was strikingly shown in several of the underfeeding experiments, in which marked changes in the melting point of the fat occurred with variations in the Reichert-Meissl number in spite of the fact that the iodin value remained abnormally high throughout the experiment.

"The more important factors influencing the effects of underfeeding on the fat constants are the character of the ration, the degree of underfeeding, and the length of the underfeeding period. Corn silage and other feeds which increase the volatile fatty acid content of butter fat, affect the degree of abnormality of the fat constants accompanying underfeeding, but not their amount of

change. The effects of underfeeding on the fat constants appear to reach a limit with a subnormal plane of nutrition of about —40 per cent. Long continued underfeeding results in more or less recovery of the fat constants from the most abnormal values, but the recovery is never complete.

"The increase in the percentage of milk fat and the changes in the character of the fat which accompany underfeeding are not satisfactorily explained by the hypothesis that underfeeding causes a transfer of tissue fat to the mammary glands. Blood fat analyses made during the height of physiological underfeeding in the case of two cows failed to show any increase in the amount of fat carried by the blood stream in comparison with normal conditions in the same animals.

"As a basis for the explanation of the effects of underfeeding on the percentage of fat in milk and on the composition of the fat, the hypothesis is advanced that the synthesis of milk fat in normal amount and its synthesis with normal composition are independent physiological functions. The production of the normal amount of milk fat is controlled by the activity of the lipases and other enzyms which accelerate this synthetic reaction in the mammary gland, and is influenced greatly by changes in the general metabolic activity of the body, particularly by the changes that affect the fat metabolism. By this hypothesis it is possible to explain the normal variations in the percentage of fat in the milk, the variations which occur with extreme weather conditions (which have a particularly strong influence on the general energy metabolism of the animal), as well as the variations in the effects of underfeeding on the percentage of fat in the milk, especially those that appear to be related to the fatness or thinness of the cow. The synthesis of milk fat of normal composition is controlled by variations in the amount and kind of material presented to the milk glands by the blood stream, from which the normal constituents of milk fat are formed, particularly those which especially characterize the milk fat, namely, the volatile fatty acids. A further extension of this phase of the hypothesis is limited by the lack of knowledge as to which constituents of the blood are utilized for the formation of normal milk fat.

"The effects of underfeeding on the composition and properties of milk and butter fat show the importance of controlling this factor in feeding experiments involving the effects of specific feeds on the composition of milk and butter. The effects of underfeeding must be taken into account in the interpretation of all data involving variations in the composition of milk and butter fat due to specific conditions of the cow, specific environments of the cow, changes in the feed of the cow, or to feeds of specific character.

"The variations in the composition and properties of milk and butter fat with underfeeding of the cow may have an important bearing on the use of such milk for human food, particularly as food for infants. Lack of data on this phase of the problem, however, makes it impossible to state how much bearing the results have in this connection."

Further studies of the relation of the quality of proteins to milk production, E. B. Hart, G. C. Humphrey, and A. A. Schaal (*Jour. Biol. Chem., 26 (1916), No. 2, pp. 457–471, figs. 4*).—In continuation of previous studies (E. S. R., 33, p. 275), data are here presented on the comparative value for milk production of the proteins of gluten feed, linseed meal, distillers' grains, casein, and skim milk powder. Three pure-bred Holsteins of large milking capacity and not with calf were used in the experiments. Each animal was placed on one ration for a 4-week period with immediate change to another concentrate, thus involving each individual cow in from 16 to 20 weeks of observation. Each ration contained approximately 2 lbs. of digestible protein of which 50 per cent

came from the particular concentrate under investigation. The total protein intake constituted about 10 per cent of the dry matter of the ration and the nutritive ratio was about 1:8.

With a daily production of from 40 to 45 lbs. of milk containing from 10 to 12 per cent of total solids, a negative nitrogen balance persisted throughout the experiments, this negative balance being very much larger with the gluten feed ration than with any of the other concentrates. Only during the period of skim milk powder feeding was one of the animals storing nitrogen. "In spite of this long negative balance milk secretion continued at the expense of catabolizing tissue. The total yield and total solids of the milk declined slightly after two months of continuous negative nitrogen balance.

"There was a marked difference in the utilization of the concentrates: Gluten feed showed a percentage efficiency of 45, oil meal 61, distillers' grains 60, casein 59, and skim milk powder 60. These data represent the efficiency in the mixture used.

"Possible errors in calculation may arise from the supplementing effect of the catabolizing tissue, thereby raising the figures above their true value, but nevertheless they do have comparative worth. . . . These studies furnish additional evidence that the nutritive ratio or plane of protein intake for milk production may vary according to the nature of the concentrates and basal ration used."

The influence of the ration on the composition of the urine of dairy cows, T. E. Keitt (*South Carolina Sta. Rpt. 1916, pp. 37–48*).—In these investigations, three lots of 1 aged cow and 1 heifer each were fed from June 19, 1913, to March 18, 1915. Lot 1 received a balanced ration of linseed meal, corn meal, and wheat bran; lot 2 cottonseed meal and linseed meal (1:4); and lot 3 cottonseed meal. The rations of all the lots were supplemented with pasturage and corn silage when the pasturage was scant.

The urine of each of the animals was secured for various 24-hour periods throughout the experiment and the amounts voided per diem, together with the urea content, are tabulated. Analytical data are also tabulated for the urine of each cow for each of these 24-hour periods, regarding the specific gravity, acidity, chlorids, phosphates, albumin, acetone, sugar, indican, total solids, ash, free ammonia, nitrogen, lime, and color.

In the case of the cow in lot 1 there seemed to be a direct relation between the color of the urine and its specific gravity—the higher the specific gravity the deeper the color. A short time before calving the specific gravity of the urine ran very low and at this time all of the constituents were quite low, probably due to large dilution. There seemed to be no definite relation between the total ash content and the content of lime and of phosphorus. The total solids varied in a general way with the specific gravity.

The phosphorus content of the urine of the heifer in this lot was lower than that of the cow, but the contents of nitrogen, urea, free ammonia, and lime were higher. The contents of nitrogen, urea, and free ammonia ran lower in these two animals than in those fed the highly nitrogenous feed, indicating that a highly nitrogenous feed throws more work on the urinary system of the animal and that the excess of nitrogen above the balanced ration is metabolized.

With lot 2 the relation between color and specific gravity did not hold. There was not much lowering of the specific gravity of the urine previous to calving in this lot. After two months of the experiment had elapsed there was a noticeable increase in the urea content of the urine of this lot, this being true irrespective of the fluctuations in volume of the urine voided. This was true of all animals receiving high protein rations, but it did not hold good for the animals on the balanced ration.

The carrying of a fetus seemed to have some bearing on the content of lime and phosphorus in the urine, this being especially noticeable in the aged cows. Immediately after calving the urine of the cow in lot 1 greatly increased in lime and phosphorus content. Later the lime and phosphorus contents became lower. With the cow in lot 2 there was a great increase in phosphorus content immediately after calving, but the lime content remained low. Beginning a month after this cow was bred again there was a marked decline in phosphorus and lime. The contents of lime and phosphorus were greatly increased after the second calving.

The content of both lime and phosphorus in the urine of the cow in lot 3 was comparatively low during pregnancy, and there was a noticeable increase in the lime content after calving. The phosphorus content of the urine of the heifer in lot 1 increased after the birth of her first calf, and the lime content after the second calf. With the heifer in lot 2 the lime content increased after calving. The phosphorus content had been high and continued so.

Report for 1915 of the united dairy experiment farm at Hoorn (*Verslag Ver. Exploit. Proefzuivelboerderij Hoorn, 1915, pp. 103, pls. 2, figs. 7*).—This contains a financial report of the institution, together with results of an experimental test of two milking machines, and studies to determine whether the fat in cheese exercises an influence on the ripening, the proteoclastic power of lactic acid cocci, the production of cleavage products of lactose by lactic acid bacteria (*Streptococcus lacticus*) in milk and whey, the normal gas formation in cheese, the Duclaux method for determining fatty acids, and the "cracking" of Edam cheese.

Milk yield tests in cows, J. Käppeli (*Milchw. Zentbl., 45 (1916), No. 2, pp. 17–24*).—Tabular experimental data of the milk yielded by cows at the Berne-Liebefeld experiment station during the years 1899–1914, together with data relative to the feed received, are submitted and discussed. It is concluded in general that for determining the total milk yield for any period of lactation weighing the milk once every two weeks is satisfactory and yields average results which are accurate enough for all practical purposes.

Certificate-of-record dairy cows.—A world's record, W. M. Singleton (*Jour. Agr. [New Zeal.], 13 (1916), No. 4, pp. 293, 294, fig. 1*).—The Jersey heifer, Mere, commenced milking at the age of 1 year and 346 days, and produced in 1 year 12,164 lbs. of milk containing 663.64 lbs. of fat. This is said to be a world's record for the production of milk fat for animals of this age.

Regulations adopted by the Argentine Rural Society for registering milk records of dairy cows (*An. Soc. Rural Argentina, 51 (1916), No. 1, pp. 74–76; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 6, pp. 856–858*).—This gives the text of the resolutions adopted by the Argentine Rural Society for the registering of milk records of dairy cows which are recognized as suitable for forming milking strains.

An experiment with milk veins, R. R. Graves (*Hoard's Dairyman, 52 (1916), No. 20, pp. 687, 717, figs. 6*).—In the experiment here briefly reported the milk veins of two cows were ligated in order to determine whether the posterior mammary veins would carry all the blood from the udder.

With one of the cows, which had been in lactation about 18 months, there was no shrinkage in milk flow following the tying of one vein, and only slight shrinkage following the tying of the other vein a week later. In the case of the other cow, which had been in milk a little over two months and had a daily milk production of about 44 lbs., the milk flow was only slightly lowered, due to the tying of the milk veins.

Postmortem examinations of these cows showed that the posterior mammary veins were about as large as the anterior veins. The author suggests that

undue emphasis is attached to the milk veins in the score cards of the various breeds of dairy cattle.

The influence of heating on creaming in milk, R. Burri (*Milchw. Zentbl., 45* (*1916*), *No. 3, pp. 33–39*).—Experimental data are submitted which show that a preliminary heating of the milk below its boiling point markedly shortens the time for complete creaming. Pasteurization at 61° C. (141.8° F.) for 30 minutes produces a very rapid and complete separation of the cream. Heating at higher temperatures increases the creaming time.

The practical significance of the results in regard to the determination of the correct temperature for pasteurization is indicated.

The behavior of Streptococcus lacticus on heating milk at 60 to 63° C. (modern pasteurization), H. Weigmann, A. Wolff, Marg. Trensch, and M. Steffen (*Centbl. Bakt.* [*etc.*], *2. Abt., 45* (*1916*), *No. 1–5, pp. 63–107*).—The results of the investigation show that after heating milk for 30 minutes at from 60 to 63° C. (140 to 145.4° F.) the lactic acid bacteria are present, in general, in a much larger proportion to the remaining organisms than in the raw milk. The same was found on heating the milk for only 10 or 20 minutes.

Milk drawn in the stable was found to contain a proportionately larger number (about double) of the acid bacteria than milk drawn in the field, while the number of acid organisms which survived pasteurization was from four to five times as great in the stable milk.

In spite of the larger proportion of acid bacteria in the pasteurized milk than in the raw milk the time of souring was considerably longer than in the raw milk. From experimental data in this connection it is concluded that the acid bacteria in the pasteurized milk were attenuated both with respect to reproduction and fermentation. The creaming of the pasteurized milk was found to be much more rapid and also more complete than in the raw samples.

The detailed bacteriological data are submitted in tabular form and discussed in some detail.

See also a previous note by Ayers and Johnson, jr. (E. S. R., 29, p. 73).

Testing milk and cream, M. R. Tolstrup and M. Mortensen (*Iowa Sta. Circ. 32* (*1916*), *pp. 2–8, figs. 14*).—Brief directions are given for testing whole milk, cream, and skim milk for fat by the Babcock method, together with some common causes for poor tests and reasons for variations in cream tests.

Why cream tests vary, H. A. Ruehe (*Illinois Sta. Circ. 192* (*1917*), *pp. 2*).—This circular gives in a concise form information as to the cause of variations in cream testing.

Caring for cream on the farm, H. A. Ruehe (*Illinois Sta. Circ. 190* (*1917*), *pp. 2, fig. 1*).—Brief suggestions are given.

Care of the cream separator, H. A. Ruehe (*Illinois Sta. Circ. 191* (*1917*), *pp. 2*).—Suggestions deemed helpful to separator operators are offered.

[Chemical comparison of two fermented milk products], A. Sanna (*Staz. Sper. Agr. Ital., 49* (*1916*), *No. 2, pp. 73–88*).—The Sardinian fermented milk product, "miciuratu" or "gioddu," is compared with the Egyptian product "leben" or "laben raieb."

VETERINARY MEDICINE.

The principles of pathologic histology, F. B. Mallory (*Philadelphia and London: W. B. Saunders Co., 1914, pp. 677, figs. 497; rev. in Jour. Bact., 1* (*1916*), *No. 5, pp. 550, 551*).—This book, which treats of pathology from the morphologic point of view, consists of two parts, the first relating to general pathologic histology (pp. 17–410) and the second to special pathologic histology (pp. 411–662). The review is by F. P. Gay.

Veterinary materia medica and therapeutics, K. Winslow (*New York: William R. Jenkins Co., 1916. 7. ed., rev., pp. [14]+781*).—This is the seventh revised edition of the work previously noted (E. S. R., 20, p. 1183). Much new data relating to therapeutics have been added, together with a number of medicinal agents not previously included and a complete section on poisons and antidotes. Spinal anesthesia is considered in detail for the first time.

Live stock sanitary laws of the State of Arkansas, R. M. Gow (*Arkansas Sta. Bul. 126 (1916), pp. 14*).—This consists of the text of the state laws, the regulations of the board of control of the station regarding them, notes on the laws and regulations, etc.

Report of the nineteenth annual meeting of the United States Live Stock Sanitary Association (*Rpt. U. S. Live Stock Sanit. Assoc., 19 (1915), pp. 194, figs. 2*).—The papers presented at the annual meeting of the association, held at Chicago, December 2 and 3, 1915, include the following: A Disease Resembling "Forage Poisoning" in Horses and Mules Wherein Oat Hay Incorporated the Primary Factor, by R. Graham, L. R. Himmelberger, and R. L. Pontius (pp. 22–42), previously noted (E. S. R., 36, p. 580); The Advisability of State-wide Compulsory Pasteurization, by W. B. Barney (pp. 42–45); Summary of Investigation on Immunization Against Anthrax, by A. Eichhorn (pp. 45–56); Infectious Pneumonia of Cattle (Hemorrhagic Septicemia), by A. T. Kinsley (pp. 56–59); Hog-cholera Investigations, by M. Dorset (pp. 59–74); Official Control of the Production and Distribution of Commercial and State Serum, by C. J. Sihler (pp. 74–78); Tick Eradication, by C. A. Cary (pp. 79–81); Advantages of Closer Cooperation Between Bureau of Animal Industry and State Officials in the Control of Contagious and Infectious Diseases, by C. Vrooman (pp. 81–83); The Use of Concrete in Sanitary Farm Equipment, by N. K. Wilson (p. 84); Cooperation with Bureau of Animal Industry in the Control and Eradication of Contagious and Infectious Diseases, by O. H. Eliason (pp. 85–89); Inspection of Live Stock for Interstate Movement, by D. F. Luckey (pp. 89–96); Sanitation in Connection with Transportation of Live Stock, by A. J. Davies (pp. 96–101); Disinfection of Local Stockyards and Farm Premises, by F. A. Bolser (pp. 101–103); and Effective Quarantine as a Factor in Controlling Foot-and-mouth Disease, by U. G. Houck pp. 103–112).

The following papers presented before the conference on foot-and-mouth disease at Chicago, November 29–30, 1915, and previously noted (E. S. R., 35, p. 74), are included in the appendix: An Ideal State Law for Cooperation Between State and Federal Authorities in Work of Eradicating Contagious Animal Diseases, by C. J. Marshall (pp. 143–147); What General and What Specific Rules Should Be Observed in Fixing the Periods and Duration of the Different Forms of Quarantine Against Foot-and-mouth Disease, by V. A. Moore (pp. 147–153); Economic Effect on Business Men as well as Farmers of Temporary Outbreaks and of Permanent Presence of Live Stock Disease, by A. J. Glover (pp. 153–159); and Quarantine Zones or Units, by J. I. Gibson (pp. 159–161).

Report of the New York State Veterinary College for the year 1913–14 (*Rpt. N. Y. State Vet. Col., 1913–14, pp. 310, pls. 15*).—The following papers are included in this report: The Diagnosis of Open Cases of Tuberculosis, by D. H. Udall and R. R. Birch (pp. 55–105); A Study of Hog-cholera Transmission, by R. R. Birch (pp. 106–114); Contagious Abortion of Cattle (pp. 115–162); Suggestions for the Repression of Abortion, Sterility, and Mammitis in Cows and of White Scours in Calves (pp. 163–174), and The Cause, Prevention, and Treatment of Retained Placenta in the Cow (pp. 175–188), by W. L. Williams; An Improved Technique for the Handling of Fistulous

Withers, by W. L. Williams and J. N. Frost (pp. 189–199); An Outbreak of Septicæmia Hemorrhagica Among Cattle in New York State (pp. 200–206) (E. S. R., 34, p. 478), and A Review of the Principal Methods Used to Standardize Bacterins (Bacterial Vaccines) with Special Reference to the Use of the Hemocytometer (pp. 207–219), by C. P. Fitch; The Determination of Anthrax by Means of the Thermo-precipitation Reaction (pp. 220–254), Tuberculosis in Pheasants (pp. 255–260) (E. S. R., 34, p. 386), and A Cystoadenoma in a Fowl (pp. 261–268), by E. M. Pickens; and The Location of the Accessible Lymph Glands in Cattle with Reference to Physical Diagnosis, by E. Sunderville (pp. 269–276).

Report of the New York State Veterinary College at Cornell University for the year 1914–15 (*Rpt. N. Y. State Vet. Col., 1914–15, pp. 224, pls. 24*).—The following papers are included in this report: Preliminary Report on the Recognition of Swamp Fever or Infectious Anemia in New York State, by D. H. Udall and C. P. Fitch (pp. 50–62) (E. S. R., 34, p. 280); Researches upon Contagious Abortion of Cattle, by W. L .Williams (pp. 63–101); Report on the Conglutination Test with Special Reference to the Diagnosis of Glanders, by C. P. Fitch (pp. 102–115) (E. S. R., 34, p. 781); Instructions in Selecting, Packing, and Shipping Tissues for Laboratory Examination, by E. M. Pickens (pp. 116–128); A Preliminary Report on Verminous Bronchitis in Dogs, by H. J. Milks (pp. 129–135); Uncinariasis in Dogs, W. E. Muldoon (pp. 136–141); The Structural Changes that Occur in Certain Nonspecific Inflammations of Joints, by S. A. Goldberg (pp. 142–181); The Limitations of Tuberculin in Detecting Tuberculous Infected Animals, by V. A. Moore (pp. 182–189); Physiologic Relations—Poultry, by P. A. Fish (pp. 190–204); and Lobar Pneumonia, So-called, in Domesticated Animals, by S. H. Burnett (pp. 205–220).

Proceedings of the Wisconsin Veterinary Medical Association (*Proc. Wis. Vet. Med. Assoc., 1 (1916), pp. 161, figs. 5*).—A report of the first annual meeting of the association, held at Madison, January 18–20, 1916.

Annual report of proceedings under the diseases of animals acts, the markets and fairs (weighing of cattle) acts, etc., for the year 1915 (*Bd. Agr. and Fisheries* [*London*], [*Vet. Dept.*], *Ann. Rpt. Proc., 1915, pp. 44*).—This consists mainly of the report of the assistant secretary, animals division, A. W. Anstruther, on the work during the year with hog cholera and the recurrence of foot-and-mouth disease. Statistical tables relating to the number of animals in Great Britain, number exported from Ireland to Great Britain, number imported from and exported to foreign countries, and diseases among animals in Great Britain are appended.

Annual report on the civil veterinary department, United Provinces, for the year ended March 31, 1916, E. W. Oliver (*Ann. Rpt. Civ. Vet. Dept. United Prov., 1916, pp. II+22+2*).—This is the usual annual report (E. S. R., 34, p. 777).

New apparatus for the veterinary laboratory, N. Mori (*Ann. Staz. Sper. Malattie Infet. Bestiame, R. Ist. Incoragg. Napoli, 2 (1914), No. 2, pp. 209–234, figs. 14*).—An apparatus for keeping liquids hot during filtration, an apparatus for sterilizing surgical instruments with steam, a container for use in sterilizing and conserving rubber stoppers used for serum vials, a new model serum vial, a culture flask for growing micro-organisms in either solid or liquid media, a support for the serum container used during the filling of a syringe, a device for holding animals (rat or mouse) during inoculation, and a support for surgical instruments during autopsies are described in detail.

The preparation of culture media from whole blood, R. A. Kelser (*Jour. Bact., 1 (1916), No. 6, pp. 615–617*).—The author describes in detail the preparation of a medium from whole fresh beef blood. In a comparative test with

beef bouillon, in which various types of organisms, including streptococci, staphylococci, *Bacillus typhi*, *B. diphtheriæ*, *B. anthracis*, *B. tuberculosis*, *B. abortus*, *B. mallei*, etc., fungi, and saccharomyces, were used, in all cases where a noticeable difference of growth was observed it was in favor of the blood media.

The medium can be used in preparing various modifications and on account of its low cost and ease of preparation it is strongly recommended.

Methods of raising a low arterial pressure, W. M. BAYLISS (*Proc. Roy. Soc.* [*London*], *Ser. B, 89* (*1916*), *No. B 617, pp. 380–393*).—"When the arterial pressure is low from loss of blood, it can not be brought back, except to a certain degree, by the injection of saline solution in volume equal to that of the blood lost. But if the viscosity of such solutions is raised to that of the blood, a return to normal height is possible. The effect of saline injections is also much less lasting than that of solutions containing gum or gelatin. The difference in this case is due to the osmotic pressure of the colloids, by which loss of water by the kidneys and to the tissues is prevented. Solutions containing gum do not produce edema in artificial perfusion of organs.

"When the fall of blood pressure is due to peripheral vasodilatation, gum or gelatin solutions, although more effective than pure saline, produce a much less permanent rise than in cases of loss of blood. No signs of heart failure could be detected and the cause of the fall of the raised pressure to its original height is still obscure. The combination of a small dose of barium chlorid, as recommended by Langley,[1] with a moderate amount of gum solution was found to be the most satisfactory method in such cases and no diminution of vasomotor excitability resulted.

"The view that fall of arterial pressure produces peripheral vasoconstriction by means of nervous channels, and that rise of arterial pressure produces vasodilatation was confirmed by artificial perfusion of a limb."

Studies in anaphylaxis, XVIII, XIX, R. WEIL (*Jour. Immunol., 2* (*1916*), *No. 1, pp. 95–124, figs. 5*).—Two studies are reported, continuing previous work (E. S. R., 34, p. 778).

XVIII. *The mechanism of delayed shock* (pp. 95–108).—Experimental data submitted show that there is, in actively sensitized guinea pigs in which the circulating blood has been largely replaced by normal blood, a delayed reaction on the intraperitoneal injection of antigen. Circulating antibody is not a factor in the production of delayed shock, since the simultaneous injection of antibody intravenously and of antigen intraperitoneally does not induce anaphylactic symptoms. "The isolated uterus effectively reproduces the picture of delayed shock if the antigen is very gradually added from a burette.

"The factors in the mechanism of acute and of delayed shock are identical, namely, the reaction of cellular antibody with freshly introduced antigen. In the case of acute shock the reaction is immediate, owing to the sudden introduction of antigen, which is, as a rule, accomplished by the intravascular route. In the case of delayed shock the reaction is delayed, owing to the cumulative effect of the gradual absorption of antigen, as from the peritoneal cavity."

It is indicated that the gradual mode of reaction of the cells may possibly explain some of the symptoms of infectious diseases.

XIX. *Simultaneous injections of antigen and antiserum.—The anaphylatoxin theory of anaphylaxis* (pp. 109–124).—Characteristic anaphylactic symptoms have been produced in guinea pigs, in exceptional cases only, by the simultaneous but separate injection of antigen and antibody intravenously. In rab-

[1] Jour. Physiol., 45 (1912), No. 4, pp. 239–260.

bits characteristic anaphylactic symptoms have never been induced by separate simultaneous injections. "The injection of previously prepared mixtures of antigen and antibody frequently produces violent anaphylactiform symptoms in guinea pigs and in rabbits. This is due to certain chemical alterations ('anaphylatoxins') which may also be produced by incubating normal serum in vitro with a great variety of substances, such as agar, starch, heterologous serum, etc. The injection of these latter substances intravenously has never been shown to produce anaphylactic symptoms. It appears, therefore, that serum in the test tube reacts quite differently from plasma of the circulating blood.

"The interaction of antigen and of antibody in the circulating blood does not give rise to toxic substances (anaphylatoxins) and does not produce anaphylactic symptoms. Anaphylaxis, by which is meant the reaction of the previously treated animal to a fresh injection of antigen, is always and invariably mediated by cellular antibody, and by that alone."

Streptothrix in broncho-pneumonia of rats similar to that in rat bite fever, Ruth Tunnicliff (*Jour. Infect. Diseases, 19 (1916), No. 6, pp. 767–772, pls. 3*).—"A streptothrix similar to *Streptothrix muris-ratti*, isolated from the blood of patients with rat bite fever, has been observed in smears and isolated in pure culture from the lungs of rats with broncho-pneumonia. An increase in opsonins and agglutinins for this organism has been found in infected rats. Acute lesions have been produced in the lungs of rats inoculated intraperitoneally with cultures of this organism."

The influence of the climatic and tellurical factors on the distribution and spread of certain animal diseases, with special reference to the conditions occurring in South Africa, D. Kehoe (*So. African Jour. Sci., 12 (1916), No. 11, pp. 474–501*).—This discussion relates particularly to tick and insect borne diseases and those caused by helminths.

Tick bite in stock and its treatment, S. T. D. Symons (*Agr. Gaz. N. S. Wales, 27 (1916), No. 11, p. 767*).—In the coastal areas of Australia the scrub tick (*Ixodes holocyclus*) is troublesome to young stock and in many cases fatal to foals, calves, pigs, dogs, and cats, particularly in the autumn and early spring. Although not producing death in the case of adult horses and cattle, its bite causes considerable irritation and pain. When attached the ticks may be destroyed by dropping turpentine or kerosene upon them. A laxative should be administered to the affected animals at once and followed by a stimulant.

Anthrax, J. A. Lanahan (*N. Y. State Indus. Com. Spec. Bul. 79 (1916), pp. 22, pls. 3, fig. 1*).—This reports upon the occurrence of anthrax in New York State, the causes of the outbreaks, and methods of control and eradication.

The treatment of glanders with salvarsan, especially suspicious horses, and its influence on the production of antibodies, H. Miessner and W. Lange (*Deut. Tierärztl. Wchnschr., 24 (1916), No. 14, pp. 127–130; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 6, p. 849*).—The results of the treatment of eight animals in a test of the value of salvarsan and neosalvarsan are reported in detail. Animals which manifested no apparent symptoms of glanders, but whose blood indicated its presence, were used. Blood examinations were made before and after the injection in order to observe the effect of the drug on the formation of antibodies.

In general the authors conclude that it is impossible to cure glanders with either salvarsan or neosalvarsan.

No very conclusive results were obtained by the blood examinations or by the serological tests. In using the agglutination test, however, a reduction of antibodies in the sick animals was observed shortly after the injection, with a con-

siderable increase a short time afterwards. The use of salvarsan or neosalvarsan might thus be of value in detecting the presence of the disease in horses.

The preparation of an antiglanders serum, P. Crimi (*Ann. Staz. Sper. Malattie Infet. Bestiame, R. Ist. Incoragg. Napoli, 2 (1914), No. 2, pp. 237–255*).—The experiments reported demonstrate that an excellent serum against glanders can be produced by inoculation of the hog, sheep, horse, or cow.

The serum produced was obtained by the subcutaneous injection of a virulent broth culture of *Bacillus mallei*. The injections were started with an initial dose of 10 cc., and for each succeeding injection double the amount previously used was injected until 6 liters of culture were used. The injections were made at periods ranging from 7 to 15 days apart.

The injection of the antiserum obtained into a pigeon which had previously been inoculated with a virulent culture of *B. mallei* showed it to possess marked prophylactic and curative properties. Used in doses of 0.25 cc. the serum produced the recovery of a pigeon 48 hours after the first injection of 0.1 cc. of a virulent culture, while the control bird was killed in 60 hours. The serum prolonged the time of death of a pigeon which had received a 0.1 cc. dose of virulent culture the previous day.

The serum used solely as a prophylactic in doses of 0.1 cc. conferred an immunity on pigeons which lasted several months.

The serum taken from an animal four months after the last injection of the virulent culture was, as might be expected, almost completely deprived of its immunizing properties.

Various methods for determining the trypanocidal activity of substances in vitro and their relation to the chemotherapy of experimental trypanosomiasis, J. A. Kolmer, J. F. Schamberg, and G. D. Raiziss (*Jour. Infect. Diseases, 20 (1917), No. 1, pp. 10–27*).—"Trypanocidal tests in vitro have been found of distinct value in chemotherapeutic researches in experimental trypanosomiasis. Substances exerting a profound trypanocidal activity in vitro are likely to prove trypanocidal in vivo, provided the drug is sufficiently nontoxic to be administered in adequate dosage. With the combined in-vitro-vivo method . . . it has been found possible to detect the trypanocidal activity of new compounds which were without effect in vivo in amounts but slightly less than the sublethal dose."

Salvarsan has been shown to possess a high trypanocidal activity in vitro. A trypanocidal activity by mercurials which is not apparent in vivo tests has been demonstrated by in vitro methods. In the combined in-vitro-vivo method described, equal parts of varying dilutions of the material are mixed with blood trypanosome emulsion and kept at 37 to 40° C., when the whole or a part is injected intraperitoneally into white rats to determine the degree of trypanocidal activity. As a part of the drug is injected its action is both in vitro and in vivo. Care must be exercised, however, against the administration of lethal doses of the drug.

The numeric relationship of infection to the chemotherapy of experimental trypanosomiasis, J. A. Kolmer, J. F. Schamberg, and G. D. Raiziss (*Jour. Infect. Diseases, 20 (1917), No. 1, pp. 35–44*).—Experiments reported demonstrate that in the chemotherapy of trypanosomiasis an important relation exists between the number of trypanosomes injected into the test animal and the trypanocidal activity on the part of the drug. This relationship is particularly evident with respect to the amount of drug necessary to effect complete sterilization.

The importance of this relationship to the results of chemotherapeutic experiments, particularly in comparative tests, is indicated.

The tubercle bacillus in the sputum and other body fluids, H. Bierry (*Compt. Rend. Acad. Sci.* [*Paris*], *163* (*1916*), *No. 21, pp. 618–621*).—Directions and brief notes on the isolation of tubercle bacilli from the blood, pleural exudate, and spinal fluid are submitted.

Summary of the conclusions reached regarding contagious abortion, V. A. Moore (*Amer. Jour. Vet. Med.*, *12* (*1917*), *No. 2, pp. 78–80*).—A discussion before the annual meeting of the U. S. Live Stock Sanitary Association, held at Chicago, in December, 1916.

The cause of the "spewing sickness" of sheep, C. D. Marsh (*U. S. Dept. Agr., Bur. Anim. Indus.* [*Pub.*], (*1916*), *pp. 4, fig. 1*).—Heavy losses have occurred on the sheep ranges in the Wasatch Mountains in Utah from what is known locally as "spewing sickness." The description of symptoms given by sheepmen has corresponded very closely with those known to result from poisoning by the death camas (*Zygadenus venenosus*). Investigations conducted in 1915 have, however, shown quite conclusively that the spewing sickness of that summer was not caused by death camas but was due to another plant, namely, *Dugaldia hoopesii*, known locally as "sneezeweed."

The present preliminary paper has been prepared with a view to furnishing sheepmen with information to enable them to recognize the plant and be on their guard against it. It is said to grow at elevations of from 7,000 to 10,500 ft., ranging from Wyoming in the North to Arizona and New Mexico in the South, and as far west as California. It is a rank-growing plant, and in some localities has largely taken possession of extensive areas on the range.

"The marked symptoms of poisoning by Dugaldia are depression, weakness, salivation, nausea accompanied with vomiting, and a weak, irregular pulse. Diarrhea is common, and bloating is a prominent symptom in sheep poisoned on the range. The effect on the pulse is especially characteristic, and it is evident that the toxic principle in large doses has a specific effect on the heart." While all parts of the plant are poisonous, experiments seem to indicate that the flowers are somewhat more so than the leaves. It is thought probable that cases of acute poisoning are rare, but it is known that sheep may be poisoned by eating from 2.5 to 3 lbs. in a single day, although most cases of range poisoning are the result of feeding extending over several days or perhaps two or three weeks. Thus far no medicinal remedy can be recommended, and the main reliance must be placed upon prevention.

Annual reports of the camel specialist for the years 1914–15 and 1915–16, H. E. Cross (*Ann. Rpts. Camel Specialist* [*Punjab*], *1914–15, pp. 21; 1915–16, pp. 27, figs. 11*).—The usual reports (E. S. R., 32, p. 184) dealing with the diseases of camels in the Punjab.

Biological investigations on hog cholera in southern Italy, N. Mori (*Ann. Staz. Sper. Malattie Infet. Bestiame, R. Ist. Incoragg. Napoli*, *2* (*1914*), *No. 2, pp. 191–206, figs. 2*).—A disease similar to the disease prevalent in hogs was produced in young healthy pigs by the subcutaneous injection of the diluted serum of the sick hogs which had previously been passed through a Berkefeld filter. Similar results were obtained by ingestion of the virus or by subjecting the animals to exposure to diseased hogs. Animals which recovered from an infection produced by subcutaneous injection of the filtered virus were found to be immune to a possible infection by ingestion of the virus. The virus which originally produced the disease in healthy animals later produced antibodies in animals which had recovered from an infection.

It is indicated that the disease which exists in southern Italy is probably the same as that recognized in America as hog cholera.

The destruction of trichinæ by cold, E. Leclainche (*Rev. Gén. Méd. Vét.*, *25* (*1916*), *No. 293, pp. 198–206; abs. in Jour. Compar. Path. and Ther.*, *29*

(*1916*), *No. 2, pp. 183–186*).—This is a review of the literature relating to the effect of cold upon trichinæ, including the work of Ransom, previously noted (E. S. R., 34, p. 680).

The occurrence of the giant nematode on the liver of a dog, W. A. RILEY and W. L. CHANDLER (*Cornell Vet., 6* (*1916*), *No. 4, pp. 209–212, pls. 2*).—The authors record a case of parasitism of the liver of a South Carolina dog by *Dioctophyme renale*, together with the pathological conditions which it induced.

Botulism, a cause of limber-neck in chickens, E. C. DICKSON (*Jour. Amer. Vet. Med. Assoc., 50* (*1917*), *No. 5, pp. 612, 613*).—Investigations of outbreaks of botulism due to the consumption of home-canned corn, string beans, apricots, etc., which resulted in the death of human beings as well as of chickens fed on remnants of the materials indicate that botulism may be a cause of limber-neck in chickens. Anaerobic bacilli, which had all the morphological and cultural characteristics of *Bacillus botulinus*, were obtained from the gizzards of several of the fowls. The fact that the *B. botulinus* toxin may be formed in certain vegetables and fruits without the addition of animal protein may explain the occurrence of this disease of domestic fowl under conditions in which access to spoiled meats can be excluded.

RURAL ENGINEERING.

The effect of sudden enlargement upon the flow of water in pipes, T. J. RODHOUSE (*Cornell Civ. Engin., 25* (*1916*), *No. 2, pp. 49–61, figs. 3*).—Experiments on the effect of the flow of water of sudden enlargement of 1 and 1.5 in. pipe to a pipe whose diameter is 2.096 in., and a study of the action of the Pitot tube under disturbed conditions, are reported. The following conclusions are drawn:

"The Pitot tube measures with a fair degree of accuracy, always within 2 or 3 per cent and more frequently within 1 per cent, the velocities of flow in a pipe where the resultant motion of the water throughout the entire cross section at the point where the tube is inserted is a forward motion, and where the distribution of velocities is symmetrical about the axis of the pipe. The Pitot tube is a means by which eddies or whirls caused by obstructions in the pipe may be detected, but it will not measure with any degree of accuracy the discharge of a pipe when inserted in the immediate region of such eddies.

"The rating coefficient of discharge of the Pitot tube for normal conditions can not be applied in the case of abnormal conditions produced by sudden enlargement where eddies exist, but immediately below the region of eddies the rating coefficient of discharge may be applied with a fair degree of accuracy. The eddies produced by sudden enlargement of section extend for the short distance of only about 2 or 3 diameters below the enlargement. The disturbance caused by sudden enlargement of section produces abnormal conditions in the distribution of velocities which continue down the pipe for a distance of about 35 diameters.

"The ratio of the mean velocity to the velocity at the center, $\frac{Vm}{Vc}$, increases in value, in the case of sudden enlargement, from a minimum near the point of enlargement to a maximum at a point about 11 diameters downstream, after which it begins to gradually decrease, approaching the value of the ratio for flow in straight pipe at a distance of 35 diameters below enlargement. The loss of head due to sudden enlargement may be expressed by the equation, $H_b=K\left(\frac{}{A_2}-1\right)^2\frac{V^2}{2g}$ a constant times the theoretical loss by Borda's formula, and in making the observations for the total loss due to this disturbance, a

distance of at least 35 diameters of the downstream section, below the enlargement must be included. The value of the coefficient K is very nearly the same in the two cases of enlargement investigated, and is approximately 0.97.

"The Pitot tube reversed, i. e., the impact point turned downstream, gives a negative pressure head which, reduced to velocity, negative, gives a value whose ratio with the velocity in the upstream direction is fairly constant for any given form of tube. But the relative values of the downstream readings to the upstream readings for different forms of tubes vary greatly. The maximum negative pressure or suction action at the impact point of the Pitot tube occurs when the direction of the axis of the opening is approximately perpendicular to the direction of flow."

Value of Kutter's "n" for metal flumes (*Reclam. Rec.* [*U. S.*], *8* (*1917*), *No. 1, p. 37*).—Tests made on the North Platte and Uncompahgre irrigation projects to determine the value of the coefficient n in Kutter's formula for metal flumes are reported. "The results indicate that 0.012 is a fair average value for n in flumes with smooth interior, and that 0.013 may be considered amply safe for design."

Holding power of nails (*Engin. Rec.*, *75* (*1917*), *No. 2, p. 71*).—From experiments on the holding power of 16d. and 20d. nails in a direction perpendicular to the length of the nail in which 2 by 12 in. yellow pine planks were nailed to fir sills and sheared off, a safe loading of 210 lbs. for 16d. and 250 lbs. for 20d. nails was assumed for use in the heel plates of the wooden flumes on the West Okanogan Irrigation Project.

Friction of bronze on bronze (*Reclam. Rec.* [*U. S.*], *8* (*1917*), *No. 1, p. 36*).—Experiments on the coefficient of friction of bronze on bronze to be used in estimating the power required in the operating mechanism for large high-pressure sluice gates are reported. The tests were made on gates at the Pathfinder, Arrowrock, and Elephant Butte dams, all of which are provided with cast bronze bearing surfaces and are operated by oil pressure on pistons moving in cylinders mounted on the gate bodies. The results are given in the following table:

Gate tests.

Dam.	Size of gates (larger dimension vertical).	Head on center of gates.	Average time of opening	Average time of closing.	Friction coefficient.			
					Average for opening stroke	Maximum for opening stroke.	Average for closing stroke.	Maximum for closing stroke.
	Feet.	*Feet.*	*Minutes.*	*Minutes.*				
Pathfinder	4.42×7.5	12	16.0	14.0	0.420	0.440	0.290	0.310
Arrowrock	5×5	48.5–54.8	10.0	11.0	.310	.420	.290	.340
Elephant Butte	3.92×5	107.3	5.2	4.2	.336	.383	.254	.268

Report on irrigation surveys and inspections, 1915–16 (*Dept. Int. Canada, Irrig. Branch Rpt. 1915–16, pp. 86, pls. 4*).—This includes the reports of the Superintendent and Commissioner of Irrigation and of the chief field inspector; a summary report on duty of water and irrigation crop reports; and reports on bench marks, on the Cypress Hills, Western Maple Creek, and Calgary irrigation districts, on international waterways, and on the Lethbridge Northern Irrigation Project, for 1915–16.

State Rivers and Water Supply Commission [of Victoria], eleventh annual report, 1915–16 (*Victoria Rivers and Water Supply Com. Ann. Rpt., 11* (*1916*), *pp. 39, pl. 1, fig. 1*).—A statement of the work and expenditures of the commission for the financial year 1915–16, and estimates for 1916–17.

The specific gravity of nonhomogeneous aggregates, P. Hubbard and F. H. Jackson, Jr. (*Amer. Soc. Testing Materials Proc., 16 (1916), pt. 2, pp. 378–402, figs. 6; abs. in Cement Era, 14 (1916), No. 9, pp. 40–43, figs. 6*).—The object of this investigation was to study methods in common use, or those which gave promise of being most satisfactory, for the determination of apparent and true specific gravity of mineral aggregates, with a view to ascertaining if possible what method is most generally applicable to all classes of materials and also the most accurate. The methods studied were as follows: (1) The ordinary displacement method as conducted by the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture, (2) the Chapman method for single specimens, (3) the Goldbeck method, (4) the Hubbard-Jackson method, (5) the Chapman wire-basket method, (6) the Le Chatelier method for fine aggregates, and (7) the Jackson method for fine aggregates. Descriptions of these tests in detail, together with illustrations, are given. Sixteen samples of crushed rock, three samples of crushed slag, a sample of gravel, and three samples of sand were used in the investigation. The following conclusions were drawn:

"(1) In the case of rock and slag an appreciable variation may exist between apparent specific gravity and true specific gravity, depending upon the absorption of the material. (2) It is impracticable by any of the methods studied to determine the apparent specific gravity of samples composed of fragments smaller than 0.5 in. in diameter. (3) Methods employing single test specimens are not safe to use for determining the specific gravity of nonhomogeneous aggregates, even when the average results of three apparently representative samples are taken. (4) In the case of nonhomogeneous aggregates consisting of fragments of not less than 0.5 in. in diameter, all of the methods employing 1,000-gm. samples are satisfactory and can ordinarily be depended upon to give check results by different operators working upon the same sample to within one in the third significant figure. (5) When determining the specific gravity of extremely nonhomogeneous aggregates, it is recommended that the average of not less than three tests, made upon different 1,000-gm. samples, be reported. (6) When it is desired to obtain as nearly as possible the apparent specific gravity of aggregates consisting of a mixture of coarse and fine particles, it has appeared advisable to separate a weighed sample of the material by means of a 0.5-in. screen, and to make an apparent-specific-gravity determination upon not less than 1,000-gm. of the coarse fraction and a true-specific-gravity determination upon not less than 50-gm. of the finer fraction. The approximate apparent specific gravity of the whole sample may then be calculated from the results obtained."

A new form of specifications for concrete aggregates, C. M. Chapman (*Amer. Soc. Testing Materials Proc., 16 (1916), pt. 2, pp. 180–193*).—This paper proposes that instead of specifying that concrete aggregates, particularly sand, be of a certain fixed minimum standard of quality, the specifications be made to read in effect as follows: The materials used shall be of such quality and shall be used in such proportions as to produce a concrete which shall show a compressive strength of 2,500 (or 2,000 or 1,500) lbs. per square inch at the age of 28 days under standard test. A brief outline of the manner in which this form of specification is utilized in practice is also given.

A method of making wear tests of concrete, D. A. Abrams (*Amer. Soc. Testing Materials Proc., 16 (1916), pt. 2, pp. 194–208, figs. 6; abs. in Engin. and Contract., 46 (1916), No. 5, pp. 102, 103, figs. 4*).—A brief review of tests used for determining the wearing resistance of concrete and concrete aggregates, especially for use in the wearing surface of roads, is given, and a method is

described for conducting wear tests on concrete blocks 8 in. square and 5 in. thick by means of the Talbot-Jones rattler.

The strength of clamped splices in concrete reinforcement bars, E. L. Lasier (*Amer. Soc. Testing Materials Proc., 16 (1916), pt. 2, pp. 209–238, figs. 12; abs. in Engin. and Contract., 45 (1916), No. 26, pp. 578, 579, fig. 1; Engin. Rec., 74 (1916), No. 2, pp. 48, 49*).—" U-bolt clamped splices of both 17- and 21-in. lengths of splice were tested to determine the load at first slip and the maximum load the splice would resist. Three different classes of splices were thus tested, (1) lap splices not embedded in concrete, (2) butt splices not embedded in concrete, and (3) lap splices embedded in concrete. The reinforcement steel in all cases consisted of 1-in. square cold twisted bars.

" The loads necessary to produce first slip had a range of from 7,000 to 50,000 lbs. The maximum loads which the splices withstood varied from 23,000 to 69,000 lbs. The ratios of load at first slip to yield point of bar for clamped splices not embedded in concrete varied from 12 to 21 per cent, and for splices embedded in concrete from 53 to 83 per cent. Ratios of maximum load to tensile strength of bar ranged from 31 to 61 per cent for unembedded splices, and from 79 to 95 per cent for embedded splices. The conclusions which may be drawn from the tests are as follows:

" The 4-in. difference in lengths of lap tested, of one bar upon the other, apparently does not affect the rigidity or strength of the splice. The clamped lap splices not embedded in concrete sustain, on the average, a slightly greater load before first slip, and a larger maximum load, than the clamped butt splices. Splices consisting of two bars of opposite twist probably sustain a greater load before first slip, and a larger maximum load, than do splices in which the bars have like twist.

" When U-bolt clamped lap splices (of the type, size, and lengths reported upon) are embedded in masses of concrete similar to those of the test specimens, the splices may be expected to withstand a stress before first slip equal to at least one-half the yield point stress of the continuous reinforcement bar. Also, the maximum strength of such splices is probably equal to at least three-fourths of the tensile strength of the bar. When U-bolt clamped lap splices (of the type and lengths reported upon) are embedded in relatively large masses of concrete, it is reasonable to suppose that first slip would not occur, or the splice would not completely fail. before the yield point or tensile strength, respectively, of the reinforcement steel had been reached; for in such cases the splices would undoubtedly fail only by the pulling out of the bars along the grooves (either through untwisting or through direct shear), and not by splitting of the surrounding concrete. In either case, unlike the results in the tests, the clamps would remain embedded in the concrete, unless the concrete prism directly compressed by the area of the upper or lower clamps were pulled out also, a condition which is not in the least likely to occur with a relatively large mass of concrete. Hence for purposes of design, it is probable that such U-bolt clamped lap splices, embedded in concrete under conditions ordinarily obtaining in actual practice, could safely withstand a unit load equal to the allowable unit stress in the steel reinforcement bars."

An apparatus for determining soil pressures, A. T. Goldbeck and E. B. Smith (*Amer. Soc. Testing Materials Proc., 16 (1916), pt. 2, pp. 309–319, figs. 3; abs. in Engin. News, 76 (1916), No. 8, p. 339, fig. 1; Engin. Rec., 74 (1916), No. 2, p. 48, fig. 1*).—This paper describes an apparatus for measuring the pressure under earth fill or against walls. A small cell having a thin brass annular diaphragm is buried at the desired position with pipe and electrical connections to an air supply and electrical equipment. Air pressure within the cell equilibrates the external soil pressure as indicated by breaking the elec-

trical contact and the pressure is read on a pressure gage. Typical calibration results are given.

Tests of boilers with bagasse as fuel, E. W. KERR (*Louisiana Stas. Bul. 160 (1916), pp. 58, figs. 5*).—Continuing work previously noted (E. S. R., 22, p. 115), data are presented obtained from several series of boiler tests made at sugar factories during the grinding seasons of 1909, 1910, 1914, and 1915. The general purpose of these tests was to study the fuel economy of bagasse as affected by varying the size and form of the combustion chamber, the air supply, the amount of overload, and the size of grate.

In 1909 twenty tests were made in five sugar factories, seventeen of which were on bagasse-burning boiler plants and the remaining three on oil-burning plants. The first plant has one 300-horsepower Stirling boiler with 3,000 sq. ft. of heating surface for bagasse and four 125-horsepower horizontal return tubular boilers for oil. The second factory has eight horizontal return tubular boilers for bagasse, making a total of 9,097 sq. ft. of heating surface and giving 758 horsepower. The third factory has four horizontal return tubular boilers for bagasse, each having 1,260 sq. ft. of heating surface, making a total of 421 horsepower. The fourth factory has nine boilers for bagasse, having a total of 16,600 sq. ft. of heating surface and a capacity of 1,383 horsepower. The fifth factory has five internally fired boilers with a total of 1,500 horsepower. All the bagasse boilers have Dutch oven furnaces.

The tests on these plants showed that decreasing the load on heavily overloaded boilers resulted in increased economy. Little change in economy could be produced by attempts to reduce the air supply by closing the ash pit doors or the fuel hopper doors. However, regulation of the draft by means of the stack damper resulted in a substantial increase in economy. An increase in evaporation of 26 per cent resulted from halving the furnace draft in a plant having a very high chimney by partially closing the flue dampers. The best fuel economy was found in furnaces having the highest temperatures. The highest furnace temperatures were invariably in the furnaces having the highest rates of combustion and the highest carbon dioxid content in flue gases. The power development by the boilers with bagasse as fuel varied from 0.89 to 1.12 horsepower per ton of cane per 24 hours, the average being 1.02. The total power development in the plant burning oil and bagasse together was 1.8 horsepower per ton of cane per 24 hours.

In 1910 a series of tests was made in connection with experiments on the question of bagasse drying. The tests were all made on a Stirling boiler with 1,000 sq. ft. of heating surface. It was found in these tests that boiler efficiency is lowered by excessive draft. Forced draft gave higher efficiency than stacked draft. This is attributed to the fact that the blower causes reduced vacuum in the furnace and consequently less inleakage of air. The stack heat loss was very high, the average being 45.16 per cent.

In 1914 and 1915 tests were made for the purpose of securing data regarding the effect of rate of combustion, volume of combustion chamber, form of combustion chamber, methods of feeding bagasse, and leakage of air into the setting upon boiler efficiency. Special attention was also given to the question of flue gas analysis. The tests were made upon four typical bagasse boilers and settings.

It was found that no particular advantage was indicated in tests of a boiler with a combustion space of unusual size and form. Higher efficiencies were obtained with a boiler having a much smaller combustion space. The highest efficiencies were obtained with higher rates of combustion. The highest rate of combustion obtained in any of the tests was 225 lbs. of bagasse per square foot of grate surface per hour in a setting with a large combustion

space. It was further found that with a large grate and open setting, together with a bagasse feeder that excluded air poorly, it was easy to have too much stack vacuum. On the other hand, it was found that a relatively small grate, in connection with a close setting and a hopper that excludes air, not only can be operated efficiently with high draft, but actually requires it.

With reference to flue gas analysis, it was found that the loss due to incomplete combustion of carbon was in most cases small as compared with the loss due to excess air. In practice it was found that if the damper is so set as to obtain a very high percentage of carbon dioxid by reducing the air there is danger of incomplete combustion due to lack of air in portions of the fuel bed.

The horsepower actually developed per ton of cane ground per 24 hours varied from a minimum of 1.16 where the fiber in the cane and the efficiency were low to a maximum of 1.44 where both the fiber and efficiency were high. In practically all cases the tests showed that boilers operated at overload gave efficiencies equal to or greater than when operated at rated or underload.

Cereal dust explosions, B. W. Dedrick (*Oper. Miller, 21 (1916), No. 12, pp. 452, 453; Miller's Rev., 35 (1917), No. 12, p. 332*).—Conclusions drawn from investigations conducted at the Pennsylvania State College, in cooperation with the Bureau of Chemistry of the U. S. Department of Agriculture and the Bureau of Mines of the U. S. Department of the Interior, are as follows:

"Hard substances, such as pieces of iron, nails, and stones, while producing sparks in passing between the grinding disks of attrition mills or other forms of disk mills along with material being ground produce no explosions, as the spark does not seem to possess sufficient intensity of heat or surface to cause ignition, and are almost instantly out as soon as emitted. . . .

"Matches are not more dangerous than the metal or stone substances in the case of disk mills or millstones, because they are fired almost instantly when coming in contact with the plates at the eye and smothered out before issuing from the mill. None of the matches were ignited when issuing from the mill. With rolls it is possible for the match to become ignited while passing between the rolls and cause a fire or possible explosion, the match stick lodging and burning, furnishing sufficient flame and heat surface.

"The spark or arc produced by static electricity does not seem to possess sufficient heat to ignite or cause an explosion of material or cereal dust as ordinarily produced in flour or cereal mills. . . . Only an electric arc, a naked flame, as a torch or lamp or burning match, apparently gives sufficient surface contact and heat to cause ignition of dust and cause an explosion which may produce merely a flash or an explosion more or less violent.

"An initial explosion may propagate and cause a flame to travel quite a long distance through conveyors and spouts. A conveyor does not seem to offer any obstruction to the flash or flame traveling through it or along its length. A damper in the spout below the mill is quite effective in preventing the flame from passing into the spout or conveyor below, so far as it relates to the ordinary light explosion, but it is possible for the flame in some instances to pass by the damper with a heavier explosion, though the force of the explosion or flash is checked or confined to the immediate vicinity of the damper. Another damper following the first would undoubtedly prevent any flame from reaching the spout or conveyor.

"When a secondary explosion follows it is generally more violent or possesses more force than the first explosion and is of wider extent.

"Dust in motion, as agitated by the blowing fan or caused by the jarring down or the sudden fall or cave in of flour or feed sticking around the side of

bins, is more liable to cause an explosion when a naked light comes in contact with it than the dust quietly floating in a room or bin."

Building code suggestions (*Nat. Lumber Manfrs. Assoc., Engin. Bur. Tech. Letter 4 (1916), pp. 12, figs. 10*).—Fire stops, careful workmanship, and proper selection of materials are discussed as safeguards in frame dwelling construction.

Building code suggestions (*Nat. Lumber Manfrs. Assoc., Engin. Bur. Tech. Letter 5 (1916), pp. 11, figs. 9*).—Chimneys, smoke pipes, and fireplaces are discussed in their relation to the fire hazard in dwellings, and detailed provisions for incorporation of these features in building codes are given.

Tests of fire retardents, with special reference to the shingle roof, H. and A. von Schrenk (*Nat. Lumber Manfrs. Assoc., Engin. Bur. Tech. Letter 2 (1916), pp. 4, figs. 2*).—Preliminary tests of fire retardents for use on shingle roofs are reported.

The tentative conclusion is drawn that "several compounds are now available which, if properly applied to wooden shingles, will give a shingle roof a very high degree of fire resistance. These same compounds at the present time have every guaranty of permanence, so far as this can be determined from a chemical investigation. They are insoluble in water and give a roof a pleasing appearance. For interior work, or for such places where direct weathering is of secondary importance, a very considerable number of compounds can be recommended, ranging from good mineral paints to more expensive materials."

The construction of cow houses (*Bd. Agr. and Fisheries [London], Leaflet 241 (rev.); Jour. Bd. Agr. [London], 23 (1916), No. 5, pp. 447–459, figs. 4*).—This article deals with the principal factors to be considered in the construction of cow houses in England, as follows: Site, general construction of buildings, internal design, air and floor space, ventilation, and lighting.

The construction of dipping tanks for cattle (*Rhodesia Agr. Jour., 13 (1916), No. 4, pp. 523–534, pls. 2*).—Specifications and working drawings of a serviceable and economical dipping tank are presented and discussed.

Ice houses and ice supply, F. M. White and C. I. Griffith (*Nat. Lumber Manfrs. Assoc., Trade Ext. Dept. Farm Bul., 6 (1916), pp. 23, figs. 5*).—This bulletin gives general information on ice harvesting and ice houses and discusses factors in the construction of ice houses, including size, insulation, foundation and floors, walls, doors, and ventilation. Designs for a farm ice house, a combination ice and cold storage room, and a homemade ice box are included.

Design of bins for materials, E. McCullough (*Cement Era, 15 (1917), No. 1, pp. 42–44, fig. 1*).—This article deals with the design of circular reinforced concrete bins for grain, coal, and other materials. Curves of data are included.

Farm sanitation, C. L. McArthur (*Arkansas Sta. Bul. 127 (1916), pp. 3–24, figs. 9*).—This bulletin deals with the location of farm buildings, the farm water supply, farm privies and sewage disposal, disinfection, flies and mosquitoes, and disposal of waste material and dead carcasses.

Sewage purification, H. Verrière (*Ann. Ponts et Chaussées, 9. ser., 32 (1916), pt. 1, No. 2, pp. 159–224, figs. 2*).—This article deals at some length with causes of the pollution of surface waters, the dangers of such pollution, self purification of surface waters, and circumstances making artificial purification of sewage necessary.

Some theoretical considerations bearing on the performance of biological sewage purification plants, G. T. P. Tatham (*Jour. Soc. Chem. Indus., 35 (1916), No. 13, pp. 711–715; abs. in Chem. Abs., 10 (1916), No. 21, p. 2779*).—A theoretical discussion of the mean time of contact of sewage liquid with filter-

ing material and the relation between the degree of purification and mean time of contact is given, together with the results of tests on fine and coarse, shallow and deep filters.

Theoretical laws and tabular data are derived which are suggested for use in the design of sewage purification systems. The laws indicate "that the purification should not even theoretically be directly proportional to the mean time of contact. The relations given involve only one constant a [oxygen avidity constant] which is dependent jointly on the nature of the sewage liquor and the method of purification adopted. . . . It is the numerical measure of the rate at which the sewage pollute is oxidized when it is present in unit concentration."

The equations and tables "give mathematical expression to the fact . . . that the size of the plant required to give a specified degree of purification increases very greatly per unit increase in the percentage purification as the latter itself increases. . . . Given the flow, it has been shown that the mean time of contact is proportional to the liquid content of the purification plant, and this in turn depends on the biological conditions obtaining inside the filter and on the physical nature of the filtering medium."

RURAL ECONOMICS.

Proceedings of the ninth Rural Life Conference (*Alumni Bul. Univ. Va., 3. ser., 9 (1916), No. 4, pp. 417–496*).—This volume contains abstracts of the papers read at the ninth annual conference held at the University of Virginia summer school, in 1916, and relating principally to rural school and church problems.

A rural survey of Lane County, Oregon, F. C. Ayer and H. N. Morse (*Univ. Oreg. Bul., n. ser., 13 (1916), No. 14, pp. 109, figs. 32*).—This survey relates primarily to the rural and educational conditions found in Lane County.

[Rural reforms in the organization of Spanish agriculture], G. Fernández de la Rosa (*Bol. Agr. Téc. y Econ., 8 (1916), Nos. 85, pp. 41–50; 86, pp. 157–166; 87, pp. 221–230; 88, pp. 318–324; 89, pp. 396–405; 91, pp. 583–593*).—The author discusses some of the causes for the lack of progress in Spanish agriculture, and advocates the federation into a national organization of all agencies working for agricultural improvement.

Semi-centennial history of the Patrons of Husbandry, T. C. Atkeson (*New York: Orange Judd Co., 1916, pp. XII+364, pls. 24*).—In this volume are recounted the activities of the Patrons of Husbandry from the initiation of the order in 1865 to date, together with statements regarding its principal officers.

History of the state agricultural and mechanical society of South Carolina, W. A. Clark, W. G. Hinson, and D. P. Duncan (*Columbia, S. C.: The R. L. Bryan Co., 1916, pp. XXII+306, pls. 13*).—This volume gives the history of the society from its foundation in 1839, and describes its activities and the men connected with it as officers.

[Agricultural law of New York] (*N. Y. Dept. Agr. Bul. 83 (1916), pp. 1955–2145*).—There have been brought together in this bulletin the laws of the State which affect agriculture.

The federal farm loan system, H. Myrick (*New York: Orange Judd Co., 1916, pp. 239*).—The author explains the various provisions of the Federal Farm Loan Act and gives the full text of the act together with amortization tables.

The farm mortgage handbook, K. N. Robins (*Garden City, N. Y.: Doubleday, Page & Co., 1916, pp. XIII+241*).—The author describes the methods used by institutions dealing in farm mortgages in granting the mortgage and in its sale to the public. He points out some differences between the placing on sale of farm mortgages and those of other types.

The land credit problem, G. E. Putnam (*Bul. Univ. Kans., 17 (1916), No. 18, pp. 107*).—The author discusses land mortgage credit in the United States, the rural credit movement, and credit for landowners, tenancy and land tenure reform, and the Federal Farm Loan Act.

The agricultural bank of the Philippine Government, J. L. Manning (*Ann. Rpt. Treas. Philippine Islands, 1914, pp. 52–58*).—In these pages are described the activities of the bank, with a statement of its resources and liabilities showing the progress made during the six years of its existence.

Cooperation in the New World, L. Smith-Gordon (*Better Business, 1 (1916), Nos. 3, pp. 212–222; 4, pp. 296–314; 2 (1916), No. 1, pp. 54–73*).—The author describes the various types of cooperative agricultural organizations found in his travels through the eastern and central parts of the United States.

Report on the working of cooperative societies in Bihar and Orissa for the year 1915–16 (*Rpt. Work. Coop. Socs. Bihar and Orissa, 1915–16, pp. 4+36+8+2, pl. 1*).—This report continues the information previously noted (E. S. R., 36, p. 290).

A manual on the preparation of crop forecasts in India (*Dept. Statis. India, Manual Crop Forecasts India, 1916, pp. 4+II+46*).—In this publication are discussed the history and development of crop forecasts, copies of the instruction sheet regarding the preparation of the forecasts for various crops, and the methods in use in certain provinces.

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt., 2 (1916), No. 12, pp. 121–140, figs. 12*).—In this number are given the acreage, average yield, total production, value and monthly prices of the principal farm crops by States, a revised estimate of the acreage contracted for by canneries, the condition of winter truck crops, the condition of winter wheat and rye sown in the autumn of 1916, the estimated farm value of important products and the range of prices of agricultural products at important markets, the production of cabbage, tobacco, sugar beets, and beet sugar during 1916, a series of tables showing the production of the principal agricultural products by States and the monthly prices, and other data.

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt., 3 (1917), No. 1, pp. 12, figs. 8*).—This number contains the usual data regarding the estimated farm value of important products and the range of prices of agricultural products at important markets, together with data showing the number and value of live stock on farms January 1, the exports of horses and mules, monthly prices of milch cows, calves, beef cattle, sheep, lambs, hogs, wool, and bulls, also index numbers of prices of meat animals. Statistical data are also shown giving the prices of live stock by ages and classes. Data are given showing the condition of truck crops, stock of potatoes on hand January 1, the yearly marketings of live stock, etc.

Missouri crop review for 1916, W. L. Nelson (*Missouri Bd. Agr. Mo. Bul., 14 (1916), No. 12, pp. 26, figs. 5*).—In this report are given the acreage, average and total yield, average farm price of principal farm products December 1, 1916, and the number of live stock being fed compared with previous years.

Farm lands in New Jersey, F. Dye and J. G. Lipman (*Trenton, N. J.: State Bd. Agr., 1916, 3. rev. ed., pp. 51, pls. 11*).—In this revision (E. S. R., 31, p. 390) the authors discuss by counties the natural characteristics and adaptability to various farm crops of the farm lands, and also include special chapters on the climate and the fruit and vegetable, canning, poultry, and shellfish industries.

[Agriculture in Argentina], H. Miatello (*Bol. Min. Agr. [Argentina], 20 (1916), No. 7–8, pp. 537–567, figs. 36*).—The author outlines the development of animal and crop production and discusses agricultural colonization and im-

migration, transportation of agricultural products, and manufacturing industries allied to agriculture.

[Agricultural statistics of Argentina] (*Extract. Estadis. Argentina, 1915, pp. 342–353*).—In these pages the area, production and value of the principal crops for 1915 are given, with comparative data for earlier years.

[Agricultural statistics of São Paulo], P. DE MORAES BARROS (*Relat. Sec. Agr., Com. e Obras Pub. São Paulo, 1914, pp. 101–133, pls. 3*).—In these pages are given data as to the production, imports, and exports of important agricultural products.

Agricultural statistics of Uruguay (*Estadis. Agr. [Uruguay], 1915, pp. XIV+134*).—In this report are shown the movement of agricultural products, the area and production of the principal crops, the number of live stock and the number slaughtered in 1915, and comparative data for earlier years.

Acreage and live stock returns of England and Wales (*Bd. Agr. and Fisheries [London], Agr. Statis., 51 (1916), No. 1, pp. 36*).—This report continues data previously noted (E. S. R., 35, p. 590).

Agricultural statistics of Portugal (*Estatis. Agr. Portugal, No. 4 (1914), pp. 272*).—In this volume are given statistical data for minor subdivisions relating to rural population, soil, climate, area and production of crops, number of live stock, and consumption of animal products.

[Agriculture in Sweden], edited by J. GUINCHARD (In *Sweden. Stockholm: Govt., 1914, 2. ed., vols. 1, pp. 1–81, 117–124; 2, pp. 27–165, figs. 85*).—In these volumes are discussed the topography, climate, flora, fauna, rural population, rural husbandry, agricultural credit, and agricultural legislation.

Agriculture [in Japan], S. SATO (*Japan Year Book, 1916, pp. 331–350*).—These pages continue the information previously noted (E. S. R., 34, p. 92).

[Agriculture in Chosen] (*Ann. Rpt. Reforms and Prog. Chosen (Korea), 1914–15, pp. 118–129, pls. 4*).—These pages continue the information previously noted (E. S. R., 34, p. 792).

[Agriculture of New Zealand] (*New Zeal. Off. Yearbook 1915, pp. 493–594, pls. 2, figs. 2*).—These pages continue the data previously noted (E. S. R., 33, p. 395) adding data for 1915.

AGRICULTURAL EDUCATION.

Report on the Agricultural Instruction Act, 1914–15 (*Canada Dept. Agr. Sess. Paper 15c (1916), pp. IV+5–214*).—This report comprises a summary showing the chief purposes for which the funds hitherto available under this act have been expended in the various provinces of the Dominion, and a review by provinces of the work carried on during the past fiscal year, including financial statements showing receipts and expenditures under the Agricultural Education Act of 1912, and the Agricultural Instruction Act to March 31, 1915. Appendixes relate to the rural school and school consolidation in Canada and the United States; school instruction in agriculture, farm mechanics, and home economics in Canada and the United States; farm demonstration work in the United States; women's work in Canada, etc.

[Agricultural and forestry education institutions in Sweden], edited by J. GUINCHARD (In *Sweden. Stockholm: Govt., 1914, 2. ed., vol. 2, pp. 119, 125–135, 187–189, figs. 2*).—An account is given of the historical development and present organization of agricultural education institutions, including agricultural, forestry, and veterinary high schools, agricultural schools, forestry schools, dairy schools, people's high schools, farmers' schools, schools of agricultural economy for women, and farriery schools.

The Wisconsin county training schools for teachers in rural schools, W. E. LARSON (*U. S. Bur. Ed. Bul. 17 (1916), pp. 40, pls. 4, figs. 2*).—This bulletin

contains a brief history of these schools, the text of the county training school law, and a report, including statistical data, on the provisions for buildings, courses of study, experience and preparation of teachers, preparation of students, the work done by graduates of these schools, the work of these schools outside of training of teachers, advantages of the training school as an institution for training country teachers, suggestions for improving the work of these schools, and other institutions in Wisconsin preparing teachers for country school work.

There are now 30 county training schools in Wisconsin, in which country school conditions are kept constantly in mind. Every school gives at least 20 weeks to the study of agriculture and some give as much as a year; nature study is emphasized throughout the course, practically all of the schools have introduced in some form the study of rural sociology and rural economics, and many give domestic science and manual training; seven have actual practice departments in connection with their institutions, while the remainder secure practice work in the public schools of the village or city in which they are located.

The training of teachers for agricultural instruction (*Agr. Gaz. Canada, 3 (1916), No. 10, pp. 916–924*).—This is an account of the present status of the training of teachers for agricultural instruction in the Provinces of Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia.

Summer school for teachers (*Agr. Gaz. Canada, 3 (1916), No. 10, pp. 925–932, figs. 2*).—A report is given on the summer schools for teachers of agriculture held in 1916 in the Provinces of Prince Edward Island, New Brunswick, Ontario, and Saskatchewan.

Information relating to the establishment and administration of county agricultural schools and agricultural departments (*Bul. Bd. Ed. Mass., No. 23 (1916), pp. 80*).—This bulletin contains comparative statements, aided in several instances by parallel columns, with reference to the authorization, control, organization, location, equipment, courses of study, qualifications of teachers, methods of instruction, conditions of admission, employment of pupils, expenditures of money, and digest of the procedure required for state approval and reimbursement, of county agricultural schools and agricultural departments in high schools, to indicate the requirements and advantages of both. The text of an act to provide for the establishment and maintenance of an independent agricultural school, an example of a farm bureau memorandum of agreement, a memorandum regarding the classification of expenditures of state-aided vocational agricultural schools, and an example of per capita cost returns, are appended.

Agricultural education in secondary schools, L. S. Hawkins (*Univ. State N. Y. Bul. 624 (1916), pp. 87, pls. 29, fig. 1*).—This is an account of agricultural education in secondary schools in New York. It deals with (1) laboratory and field instruction, including poultry class projects at the Hamburg and Highland high schools, a farm crops class project at the Le Roy High School, a dairy class project at the Perry High School, a joint project by the agricultural and home making departments at Lowville, and stock judging at Canton and Alfred; (2) home projects, (3) summer work of the teachers of agriculture, (4) the summer conference of teachers of vocational agriculture at the New York State College of Agriculture, including an outline of a four-year course in agriculture being tried out; (5) apprentice teacher training by the New York State College of Agriculture (E. S. R., 33, p. 795); (6) courses in home making; (7) extension work; and (8) the growth and development of agricultural instruction in a small high school.

Women's institutes of Ontario, 1915 (*Rpt. Women's Insts. Ontario, 1915, pt. 1, pp. 191*).—This report contains the proceedings of the annual conventions of 1915, selected papers, and statistical data. The work now comprises 892 branches with a membership of about 30,000.

Some suggestions on the organization of school gardens, A. H. Rosenfeld (*Rev. Indus. y Agr. Tucuman, 6* (*1915*), *No. 4, pp. 139–148*).—In this discussion the author distributes school garden instruction over three years and suggests the work to be undertaken in each.

A course in agriculture for the high schools of Michigan, W. H. French (*Mich. Agr. Col., Dept. Agr. Ed. Bul. 14* (*1915*), *pp. 76, figs. 3*).—This bulletin contains an outline of a course in agriculture for the high schools of Michigan. It includes suggestions and syllabi on the several subjects to be taught; suggestions to school officers on the qualifications and time of employment of teachers of agriculture, rooms and equipment, etc., and suggestions to teachers on methods of instruction, including extension work, school and home projects, field trips, etc. The course in agriculture is elective and includes one unit in each grade of the high school, thus making a four-year course. Each agricultural subject constitutes a half unit. There should be daily recitations for two or three days each week, other days being given to laboratory work and to study and observation in the experiment plat and on farms. An agricultural reference library and sample score cards are appended.

Elementary agriculture, J. S. Grim (*Boston: Allyn and Bacon, 1916, pp. XVI+490+12, pl. 1, figs. 336*).—This book consists of five parts, viz, rural life and activities, the soil and its improvement, crops, stock, and farm economics, with practical questions, suggested home exercises, suggestions to teachers, and references to the literature at the end of each chapter. Charts showing the distribution of United States products, lists of farm journals and magazine articles, a sample constitution and by-laws of a boys' pig club, directions for the use of Farmers' Bulletins, a report of a pupil's project, etc., are appended.

Chemistry of the farm and home, W. E. Tottingham and J. W. Ince (*St. Paul, Minn.: Webb Publishing Co., 1916, pp. 434, figs. 115*).—This text, for secondary schools giving instruction in agriculture, comprises five chapters in general chemistry to serve as a foundation for the succeeding chapters on chemistry as applied to the plant and its products, the soil, fertilizers, farm manure, the animal and its products, feeding of animals, dairy products, human food and dietetics, and miscellaneous materials of importance in daily life. Each chapter ends with a summary and review questions. The book concludes with 126 laboratory exercises, and appendixes containing a list of supplementary books and bulletins, data on soils and feeding stuffs, required chemicals and apparatus, etc.

A laboratory manual of soil bacteriology, E. B. Fred (*Philadelphia and London: W. B. Saunders Co., 1916, pp. 170, figs. 13*).—This laboratory manual is intended primarily for students of soil bacteriology, soil chemistry and physics, and plant pathology, it being assumed that the student has had previous training in general bacteriology and chemistry. The manual consists of exercises in soil bacteriology which, as far as possible, are planned to give quantitative results, formulæ and methods, a list of apparatus for one student, a list of some of the more important books and journals treating of bacteriology, and laboratory rules.

Sixty-two experiments in crops, C. L. Quear (*Muncie, Ind.: Industrial School Service, 1916, pp. 89, figs. 45*).—This laboratory manual has been prepared for the seventh, eighth, and ninth grades of the public schools. The experiments are arranged in four sections, viz, plant composition, cereal crops, forage crops, and plant economics, following somewhat carefully in the order

of topics presented the following psychological principles: (1) The instincts which characterize the pupil during his adolescent period, (2) the ideas and experiences which he has formerly acquired which relate themselves in such a way as to help him in the clear grasp of agricultural facts, (3) the economic phase, and (4) habits previously acquired by the pupil.

The chemistry of the garden, H. H. Cousins (*London: Macmillan & Co., Ltd., 1916, rev. ed., pp. XIX+143*).—This small volume treats the subject in a nontechnical way under the following chapters: How plants grow, the air, the soil, the fertility of the soil, manuring, organic manures, artificial manures, garden manuring, fungicides, and insecticides.

Practical school and home gardens, G. W. Hood (*Lincoln, Nebr.: Long and Co., 1916, pp. [6]+181, figs. 114*).—This book is suitable for school work between the sixth and twelfth grades and for home gardening. Chapters are devoted to the value of a plant, planning the garden, the seed and how to plant it, the soil and its treatment, the hotbed and the cold frame, plants that should be started in the hotbed or the cold frame, spray material and spray machinery, vegetables grown for their roots, vegetables grown for their green parts, vegetables grown for their fruit and seed, and perennial vegetables. At the end of each chapter are review questions and references to literature. Directions are added for making 24 gardens, including suggested plans and records.

Agricultural woodworking, L. M. Roehl (*Milwaukee, Wis.: The Bruce Publishing Co., 1916, pp. 137, figs. 122*).—This is a group of problems for rural and graded schools, agricultural high schools, and the farm workshop. They include plans and lists of material required for making practical articles used in the home and about the farm, hog, poultry, and pigeon houses, a silo form, implement shed, corncrib, combined dairy and horse barn, combined horse and cow barn, plan for a farmstead, etc. A number of these problems appeared in a pamphlet entitled Manual Training for the Rural Schools (E. S. R., 36, p. 96).

MISCELLANEOUS.

Twenty-ninth Annual Report of Alabama College Station, 1916 (*Alabama Col. Sta. Rpt. 1916, pp. 28*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1916, and reports of the director and heads of departments on the work of the station during the year.

Twenty-eighth Annual Report of Colorado Station, 1915 (*Colorado Sta. Rpt. 1915, pp. 30*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1915, a report of the director on the work and publications of the station, and departmental reports.

Twenty-ninth Annual Report of South Carolina Station, 1916 (*South Carolina Sta. Rpt. 1916, pp. 64*).—This contains the organization list, a report of the director on the work of the station, a financial statement for the fiscal year ended June 30, 1916, departmental reports, of which that of the botanist and plant pathologists is abstracted on page —, and two special articles abstracted elsewhere in this issue.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 4 (1917), No. 11, pp. 16, figs. 2*).—This number contains brief articles on the following subjects: Udder Diseases and Their Treatment, by J. W. Kalkus; Celery Culture in Western Washington, by J. L. Stahl; and Breeding for Egg Production, by Mr. and Mrs. G. R. Shoup.

NOTES.

Arkansas University.—The state legislature has appropriated $481,000 for the ensuing biennium for the divisions of liberal arts, agriculture, engineering, and education. This is an increase of approximately 50 per cent over any previous appropriation. An act was also passed whereby the university will hereafter be maintained by a special tax of four-ninths of one mill on all taxable property in the State.

Delaware College and Station.—The state legislature has appropriated a total of $285,890.27 to the college for the ensuing biennium. Among the items authorized are $125,000 for the new dormitory at the women's college, $32,000 per annum for the maintenance of that college, $32,000 for a new heating plant, $14,000 per annum for general maintenance, $10,000 per annum for the maintenance of the agricultural department, $7,890.27 for agricultural extension, and $4,000 to replace the loss of revenue due to the transfer of the fertilizer control work to the State Board of Agriculture.

Hawaii College.—Dr. J. F. Illingworth has resigned as entomologist to accept an entomological position in north Queensland for a three-year period, beginning about June 1.

Illinois University.—A field of 32½ acres, located near Elizabethtown in Hardin County, has been presented to the university for experimental purposes by a donor whose name is withheld. This is the twenty-sixth tract to be given the university for agricultural work. In addition two pieces of land have been purchased and 16 are under lease, making 44 fields under cultivation by the college of agriculture in different parts of the State.

Indiana Station.—Director Arthur Goss, who has been at the head of the station since 1903, has resigned, effective September 1, to give his entire attention to his extensive farming interests near Vincennes.

Iowa Station.—A. A. Dowell, instructor in animal husbandry, has resigned to assume charge of the department of animal husbandry in the University of Alberta, vice Kenneth McGregor, who is to engage in farming.

Kansas College and Station.—A law was recently passed abolishing the state boards of control, educational administration, and corrections, and creating a single board in their stead. The new board consists of five members of whom the governor is chairman, and will have charge of all state educational, benevolent, and penal institutions beginning July 1. Provision is also made in the act for the appointment for all institutions under its jurisdicton of a general manager at a salary not to exceed $6,000 per annum.

The legislature has appropriated $80,000 to the college for the purchase of land to be used for animal husbandry, dairy, and poultry farms, and $50,000 for an addition to the agricultural building.

Warren Knaus, of the class of 1882, has given to the entomolgical museum of the college his extensive collection of Coleoptera.

M. N. Levine, research assistant in plant pathology at the Minnesota Station, has been appointed assistant plant pathologist.

Louisiana Stations.—W. R. Griffing has been appointed assistant plant pathologist.

Michigan College and Station.—V. M. Shoesmith, professor of farm crops and farm crop experimentalist at the station since 1910, has accepted a position as superintendent in the development of a 4,300-acre tract of land near Grand Rapids.

Massachusetts College and Station.—Dr. A. E. Cance, head of the department of agricultural economics, has been granted leave of absence to work in cooperation with the New England Committee of Food Supply, which is endeavoring to organize a more efficient system of distributing food products. Miss Lorain P. Jefferson, research secretary of the division of rural social science, has been appointed acting head of the department during his absence.

F. A. Waugh has been granted six months' leave of absence beginning April 1 to take up work as consulting landscape architect in the Forest Service of the U. S. Department of Agriculture. In this capacity he will visit many of the National Forests with a view to suggesting means tc conserve their natural beauties and outline a general policy for the landscape treatment of forest areas.

Robert S. Scull has been appointed assistant chemist beginning February 1.

Minnesota University and Station.—The division of agricultural biochemistry has completed its organization and equipment for instruction and research in plant chemistry. Opportunity is now afforded for graduate work in this subject leading to the M. S. and Ph. D. degrees. The research projects available for investigation in 1917–18 include the strength of wheat flour, the chemistry of resistance to disease in plants, the enzyms of fruits and their relation to ripening processes, the chemistry of pollen, and protein investigations.

The resignations are noted of J. Russell Winslow, assistant in the division of agricultural biochemistry, effective January 31; E. C. Higbie, superintendent of the West Central School and substation at Morris, effective July 31; and F. J. Piemeisel, research assistant in plant pathology, to become scientific assistant in the Office of Cereal Investigations of the U. S. Department of Agriculture.

Missouri University.—Recent appointments include Roy Hastings and Paul B. Naylor as assistants in agricultural extension, and T. S. Townsley, formerly assistant in poultry husbandry at the Kansas College, as extension instructor in poultry husbandry.

Nebraska Station.—R. R. Spafford has been appointed assistant in farm management.

Nevada University and Station.—The term of office of regents of the university has been extended to ten years instead of from two to four years, one regent henceforth being elected every two years for the full term. The legislature made an appropriation of $2,000 for general running expenses of the station.

Rutgers College.—Under a recent act of the state legislature the scientific departments of the college have been designated as the State University of New Jersey.

New Mexico College and Station.—Dr. George E. Ladd has resigned as president and has been succeeded by Dr. A. D. Crile.

The station has received an increase of $2,500 per year in its State appropriation from the recent legislature. J. G. Hamilton, assistant agronomist has resigned, effective March 1, to become county agent in Valencia County.

Cornell University.—A series of news notes for the use of the press dealing with the use of our agricultural resources, such as the need of supplying the staple foods, the increase of food production and elimination of wastes in marketing, the development of home gardens, and the lessening of food wastes

and other wastes on the farm and in the home has been begun. These new notes supplement the regular series of press bulletins, which will be continued as heretofore.

North Carolina College and Station.—The station officials are cooperating with the extension division to promote a campaign for safe farming. The State seems to be well aroused as to the advantages of producing food and feed crops on the home farm, several thousand letters having been received requesting information as to the proper cultivation, fertilization, etc., of these crops. The question of the home garden has aroused especial interest among both city and country people.

E. E. Culbreth, assistant in the division of markets and in charge of the accounting systems of the credit unions, has resigned to accept a commercial position. Dr. I. M. Hawley has been appointed nursery inspector.

Ohio Station.—W. C. Boardman and O. H. Smith, assistants in the soil survey, have resigned. Sidney Bliss has been appointed assistant in the department of soils.

Oregon College and Station.—O. G. Simpson, assistant professor of dairy manufactures and dairy manufacturing specialist, has resigned to become manager of the Oregon Cooperative Dairy Exchange. J. O. Beck has been appointed instructor in dairying, vice D. C. Howard, who has been appointed county agent of Columbia County.

Pennsylvania College.—A tract of 60 acres adjoining the present experimental orchard is to be developed with a view to affording instruction to students in the commercial operations of fruit growing. About 20 acres will be planted to apples, 7 to peaches, 4 to grapes, 8 to small fruits, 1 each to pears, plums, and cherries, and 3.5 to nuts, while 5 acres will be used for variety tests and studies of the botanical species from which the fruits have sprung. It is planned to provide eventually a foreman's house and facilities for spraying, packing, etc. The courses are to be so arranged as to permit of spending half-day periods at the orchard.

J. B. Scherrer, of the New Hampshire College and Station, has been appointed assistant professor of vegetable gardening extension, effective April 15, and J. Martin Fry, assistant in agricultural extension, beginning February 1. Ralph A. Waldron, instructor in botany, has resigned to take up graduate work at the University of Pennsylvania.

Porto Rico Federal Station.—Harvey E. Thomas, assistant plant pathologist at the Virginia Station, has been appointed plant pathologist.

South Carolina College and Station.—H. W. Barre has been appointed director of research, beginning April 4. He will thus become director of the station, vice J. N. Harper, whose resignation has been previously noted, but not dean of the college, that office having been dropped for the present.

Utah College and Station.—A. W. Ivins of Salt Lake City, J. W. Knight of Provo, Mrs. Lois C. Hayball of Logan, A. G. Barber of Logan, and Frank B. Stephens of Salt Lake City have been appointed to the board of directors, vice Thomas Smart, J. Q. Adams, J. M. Peterson, Annie K. Hardy, and Joseph Quinney, jr.

The policy of the State toward the college and station was slightly changed by the last legislature by substituting for the continuous appropriation method the inclusion of estimates in the governor's budget. A substantially increased appropriation for the ensuing biennium was granted, of which the station receives $7,500 additional and the extension work $5,000 additional, together with $61,100 for buildings and improvements and $6,000 for pure bred live stock and pasture.

Washington Station.—A state office of farm markets has been established, attached to the station. The director is to be appointed by the director of the station with the approval of the governor. The study and improvement of market conditions is to be taken up and a market news service will be maintained. The act carries an appropriation of $15,000 for the biennium.

Dr. I. D. Cardiff has resigned as director of the station, his resignation to take effect during April.

West Virginia University and Station.—Under the will of the late Lawrence A. Reymann the station receives an estate of about 931 acres of improved land and a herd of about 125 pure bred Ayrshire cattle, the total value being about $120,000. The land is located on Capon River, in Hardy County near the Virginia line, and is well equipped with buildings, farm machinery, etc., including a recently constructed cheese factory. The purpose of the gift is expressed as to promote, develop, and advance the science of agriculture in its most comprehensive scope, and in addition to give special attention to the breeding and development of Ayrshire cattle. The station obtained possession March 1, L. F. Sutton being placed in charge as superintendent.

Wyoming Station.—Earl O'Roke, instructor in zoology at the University of Kansas, has been appointed assistant zoologist and parasitologist beginning March 1.

Canadian Experimental Farms.—An experimental flax mill has been erected at the Central Experiment Farm at Ottawa and is being equipped for comprehensive experimental work in fiber manufacture. Field work with flax and hemp is also to be conducted at Ottawa, several branch stations, and elsewhere, in an attempt to determine the areas in Canada suitable for the industry and to work out problems connected with its development.

Research laboratories for special studies of grain rust are being established at Brandon, Manitoba, and Indian Head, Saskatchewan. W. P. Fraser, assistant biologist in Macdonald College, has been appointed to take charge of this work.

Agricultural Development in Ontario.—In a special effort to populate and bring under cultivation large areas in northern Ontario, an agricultural high school and demonstration farms at New Liskeard, a government creamery at the same place, a 50-acre demonstration field near Matheson, and a plant breeding station at Ft. William are to be established. W. R. Leslie, a graduate of the Manitoba College, is to take charge of the breeding station.

Plans are also under way for the necessary buildings and equipment for a new agricultural school to be established, through the Ontario Department of Agriculture, near Kemptville in eastern Ontario. It is intended to give useful and practical instruction in agriculture to young men between the ages of 16 and 25 who have left school and domestic science instruction to young women. It is not proposed to duplicate anything already being done in the Province unless to some extent the first two years of the course at the Ontario Agricultural College. The regular course will not be longer than two years and there may also be a number of short courses.

Special provision has been made in Ontario for the obtaining of homesteads by returning soldiers. These soldiers will first be sent to an agricultural training depot being established at the government experimental farm at Monteith, where they will receive instruction. When a sufficient number have been trained, a farm colony will be opened at some point along the railway in charge of a competent superintendent. Farms containing not over 80 acres will be laid out and so planned as to bring the various farm houses as closely together as possible. A 10-acre tract will be cleared on each farm, and when this is completed the farm may be allotted free of charge to a soldier. He may also receive machinery, live stock, etc., to the value of $500, this being

reimbursable within twenty years. The final title to the land willl be given after five years. The community system will be followed in supplying horses, other stock, and implements, and cooperative methods of buying and selling will be used.

Other plans for placing soldiers on the land are also under consideration.

Agricultural Instruction in Western Canada.—In 1916 the provincial ministry of agriculture of British Columbia, which until then had always been united with some other ministry, was made a separate and distinct department and placed in charge of William Manson.

During the past year 90 acres of the agricultural college site at the University of British Columbia have been cleared and prepared for cropping and for a botanical garden. A collection of upwards of 26,000 specimens, representing nearly 800 species, of the native flora of British Columbia, which has been made during the past four years by John Davidson, the Province botanist, is to be transferred to the university campus, as a nucleus for a botanic garden. The last session of the legislature appropriated sufficient funds to permit of a beginning to be made in the erection of suitable farm buildings and the purchase of live stock and equipment.

Regular degree courses in agriculture will not be offered in the college during the present academic year, but it is hoped that a series of short courses will be given, including the course on the scientific basis of agriculture offered as an elective last year (E. S. R., 34, p. 696). F. M. Clement, who for several years has been director of the Horticultural Experiment Station at Vineland, Ontario, has been appointed professor of horticulture and P. A. Boving, who for the past three years has been in charge of root investigations at MacDonald College, assistant professor of agronomy.

Agricultural instruction has recently been introduced into the high schools of British Columbia in a systematic way. The first class in the Province was organized in September, 1915, and was followed by similar instruction in four other high schools in September, 1916. The instruction is being given by agricultural specialists, and is attended by a total of about 130 boys and girls. A two-year course has been outlined for these schools including the study of soils, fertilizers, and drainage; fodder, grain, and root crops; vegetable and flower gardening; fruit growing; animal and poultry husbandry; dairying and bee keeping; farm accounting and marketing; farm mechanics for boys; and special practice in the purchase and preparation of foods for girls.

Equipment costing about $400 is available in each school, with from one-half to one acre of land for experimental and demonstration plats. The salary of the instructor is paid by the provincial department of education, and the remaining expenses by the local authorities.

The Alberta Department of Agriculture began extension work in agriculture last spring with district agents in the field at various points in the Province. The minister of education is cooperating to the extent of making the time of the classes in school available to the agents for the carrying on of the work in cooperation with the teacher and inspector. The plan is to have the pupils take actual part in the growing of garden crops, the raising of chickens, and the feeding and management of young stock on their own farms. Initial group instruction in the laying out, planning, and general cultivation of the home garden is given in the schools, where leaflets and bulletins, seeds, and a limited number of eggs are distributed. Competitions in caring for stock are carried on and the season's program culminates in a fall fair held in conjunction with the district fair or at the most convenient school or village center. The work is being conducted in five centers and about 100 schools are taking part in it.

Agricultural Progress in Latin America.—A law recently enacted in Colombia provides for the establishment of a series of stations in which agricultural investigations, such as experiments and demonstrations, application of chemical fertilizers, and the cultivation and acclimatization of plants, will be carried on and exhibits will be made of modern agricultural machinery and tools. Each station will maintain a special agricultural meteorological bureau and be equipped for the study of insects injurious to plants, for analyses of soils and waters, and for the importation and distribution of seeds, plants, fertilizers, and animals for breeding purposes. It is also expected to issue a monthly bulletin as the official organ of these stations.

A proposition is under consideration in Argentina for the establishment of a central institution for experimental work in agriculture under the immediate direction of the minister of agriculture. This institution would be located in the capital and would contain at the start an agricultural chemical laboratory, an office for seed control, an office for the study and inspection of agricultural machinery, an office of agricultural botany, an office of vegetable pathology and agricultural entomology, and a meteorological observatory.

According to the *Bulletin of the Pan American Union* a practical school of agriculture has been opened at Aconcagua, in Chile, and steps have been taken to found an agricultural school for women in the Province of Aconcagua.

In Costa Rica a professional school fr girds was inaugurated on June 1, 1916, in San José, equipped for giving practical instruction in domestic arts and science and such other subjects as may be deemed desirable.

The agricultural school at Challapata, Bolivia, for the instruction of the natives has been moved to Rosario Plantation, near the town of Challapata, and enlarged.

It is announced that the Department of Fomento, in Mexico, has decided to establish a nursery for tropical plants in one of the States of the Republic bordering on the Gulf of Mexico. The principal feature of this nursery will be to furnish to small farmers the most desirable varieties of tropical food plants suitable for cultivation on the east coast of Mexico, such as bananas, mangos, pineapples, alligator pears, lemons, oranges, etc.

A national school of domestic arts for women, patterned after the Swiss schools of domestic science, has been founded in the City of Mexico by the department of public instruction.

Cambridge University.—A proposal to establish an institute of agricultural mechanics has been formally approved by the university senate. It is proposed to establish this institute in connection with the schools of engineering and agriculture with financial support from the Development Fund. The employment of an engineer as director and an agriculturist as an assistant director has been authorized.

Amsterdam Colonial Institute.—According to a note in *Nature*, there has been a movement in progress in Holland for the establishment of a colonial institute in Amsterdam commensurate with Dutch colonial interests, and adequately representative of the important part which Holland has taken in the prosecution of research in tropical agriculture and forestry. The promoters of the new institute have been able to secure the transfer of the economic collections, publications, and staff of a small but important colonial museum at Haarlem to the Amsterdam institute. The latter is at present housed in temporary quarters, but about $643,200 is available for the construction of buildings and the installation of the new institute. It will apparently be supported mainly by subsidies from the government, the province of North Holland, and the city of Amsterdam, and by subscriptions from private individuals and firms. In 1914

the ordinary annual expenditure was $36,582, but for 1915 the estimate was $31,356, the reduction being due to war economies.

The present organization of the institute comprises three sections, viz, economic (which is practically the Haarlem museum transferred to new quarters), anthropological, and tropical hygiene. A site for the new buildings has been secured on the Oosterbegraafplaats, where a building to house the administrative offices and the economic and anthropological sections will be erected. A special building for the section of tropical hygiene will be constructed as a part of the buildings of the Hygienic Institute of the University of Amsterdam, with which this section will work in close cooperation. The institute has issued a number of publications, including a concise history by Dr. Sirks of research in natural science in the Dutch East Indies in *Koloniaal Instituut te Amsterdam, Mededeeling, No. VI. Afdeeling Handels-museum, No. 2.*

Necrology.—Charles A. Muntz, the distinguished French agricultural chemist, died recently at the age of 71 years. He was widely known for his studies on air, soil, and agricultural products generally. Professor Muntz was of Alsatian birth and began his scientific career with Boussingault. His first important work was in connection with Schloessing in 1878, showing the biological nature of nitrification. Subsequently he made additional studies of nitrification, as well as working on mannit and other sugars and the nutrition of animals. He was the author of many scientific articles, a treatise on manures, etc.

The death in January is reported of Professor J. B. Auguste Chauveau, noted for his researches in comparative physiology and pathology, at the age of 90 years. Professor Chauveau's pathological work dealt mainly with the nature of contagion and viruses. He was especially well known as a physiologist, notably for work in glycogenesis and sugar utilization. He was one of the founders of *Journal de Physiologie et Pathologie Général*, and the author of the well known treatise on the Comparative Anatomy of the Domesticated Animals.

George Massee, mycologist and head of the cryptogamic department at the herbarium of the Royal Botanic Garden, Kew, until his retirement in 1915, died February 17, aged 67 years. He had been a frequent contributor on mycological subjects for many years.

Miscellaneous.—The home economics subsection of the Association of American Agricultural Colleges and Experiment Stations has appointed a committee to investigate the status of research in home economics at these institutions. The committee consists of Miss Louise Stanley, University of Minnesota; Miss Amy L. Daniels, University of Wisconsin; Miss Edna N. White, Ohio State University; Miss Ruth Wheeler, University of Illinois; Dean Mary E. Sweeny, University of Kentucky; and Dr. C. F. Langworthy, U. S. Department of Agriculture.

Sir Arthur Lee has been appointed director general of food production in Great Britain, Hon. E. G. Strutt, scientific technical expert, and A. D. Hall, agricultural adviser. A. D. Hall has also been appointed permanent secretary to the Board of Agriculture and Fisheries, vice Sir Sidney Olivier resigned.

The fifth annual conference of the American Association of Agricultural College Editors will be held at Cornell University, June 28 and 29.

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EXPERIMENT STATION RECORD.

Vol. 36. JUNE, 1917. No. 8.

In the passage of the Federal Aid Vocational Education Act another important step has been taken by the Federal Government in its relations to education. Under the new measure, federal appropriations ultimately aggregating over $7,000,000 per annum have been made available for cooperation with the States in the promotion of vocational education in agriculture, the trades and industries, and home economics, including the preparation of teachers. The principle of federal aid through the States to education in institutions of subcollegiate grade has been established, and an additional set of administrative machinery has been devised to operate the new system of education which is provided.

As a pioneer measure, the new legislation inevitably recalls the original Morrill Act. Primarily both laws were apparently intended to provide training in agriculture and the industries, the one in collegiate, the other in subcollegiate, institutions. They were thus both designed to develop a type of education of the utmost importance to our country, but previously never directly supported by the Federal Government and to only a limited degree by the States and local communities. Likewise both acts involved the introduction of a new system of education into the existing system.

It is somewhat remarkable that these two measures, separated in time by a period of over half a century, should both have been enacted in a period of great national crisis. The Morrill Act of 1862 was of course signed in the midst of the Civil War, while the Vocational Education Act of 1917 antedated by only a few weeks the formal entrance of the United States into the present conflict. The coincidence is the more striking since both measures were designed to foster agriculture and the industries, foremost among the arts of peace, and since both had been pending in Congress for years before the outbreak of hostilities.

Early in 1907 a bill was introduced into the House of Representatives by Hon. Charles R. Davis of Minnesota, providing annual federal appropriations for industrial education in agricultural high schools and in city high schools. In a speech a few weeks later, explaining the bill, Mr. Davis said, "It is mainly for the purpose of

encouraging the type of education for the mass of our people which will train them for the practical affairs of life. . . . It proposes that we give our workers a square deal, by giving them a chance to secure technical training as we now provide technical training for the professional classes."

This bill differed widely as to details from the measure eventually enacted. It contained a plan for the maintenance of branch experiment stations and made no provision for the training of teachers. Subsequently it was reintroduced into later sessions of Congress, as were also a considerable number of other bills having in view the same purpose of fostering secondary education in agriculture, the mechanic arts, and home economics. One of these, introduced by the late Senator J. P. Dolliver of Iowa, which also included provisions for teacher training in vocational subjects at State normal schools and extension work in agriculture at the colleges of agriculture, received a favorable report from the Senate Committee on Agriculture and Forestry in 1910.

An elaborate measure, introduced in 1912 by Senator Carroll S. Page of Vermont and embodying substantially the same objects as the bill just mentioned, was likewise favorably reported by the Senate committee, and in 1913 this measure with some modifications was substituted by the Senate for the text of an agricultural extension bill which had passed the House. No agreement was reached between the two Houses, however, as regards these measures before the adjournment of that Congress.

In 1914 the appointment was authorized of a commission to study the entire question of national aid for vocational education. This commission, of which Senator Hoke Smith of Georgia was chairman, submitted an extended report later in the year, as previously noted in these pages (E. S. R., 31, p. 402). It advocated a system of schools of subcollegiate grade for pupils over 14 years of age, stating that " the most opportune time to train the boy is during his adolescent period, when he has already gained much knowledge of farm work and its requirements, and is at the age when he is most ambitious, most alert, and therefore most teachable." It laid much stress on the desirability of directed or supervised farm practice, and considered as fundamental the necessity of providing facilities for the adequate preparation of teachers.

Endorsements for the principle of federal aid for vocational education, few in number at first, had been steadily accumulating during the years the question was under consideration. The National Society for the Promotion of Industrial Education, the National Education Association, the National Grange, the American Federation of Labor, the American Home Economics Association, and the International Congress of Farm Women may be cited as types of the many

organizations which at various times signified their approval of the general policies involved.

The subject is naturally one of intimate concern to the land-grant colleges, and had been prominently before the Association of American Agricultural Colleges and Experiment Stations on a number of occasions, notably at Washington, D. C., in 1910 and at Columbus. Ohio, in 1911. At the Washington meeting it will be recalled the association declined to commit itself upon the proposition, but in 1911, when considerable modification had been proposed, a motion was adopted favoring "federal aid for public schools of secondary grade, providing secondary education in agriculture, home economics, the trades and industries, including manual training, and for the education and professional training of teachers for these schools in the several States as may be determined by the legislature." The association also declared its belief that legislation to this end should be "in harmony with the Morrill and Hatch Acts, preserving the autonomy of the several States in the distribution of funds and in the administration of secondary education as now provided in the case of the agricultural colleges and experiment stations."

The measure ultimately adopted was introduced into the Sixty-fourth Congress by Senator Hoke Smith on December 7, 1915, and was passed by the Senate with amendments July 31, 1916. Its early enactment was strongly urged by President Wilson in addressing Congress at its reopening in the following December, as "of vital importance to the whole country because it concerns a matter too long neglected, upon which the thorough industrial preparation of the country for the critical years of economic development immediately ahead of us in very large measure depends . . . . It contains plans which affect all interests and all parts of the country, and I am sure that there is no legislation now pending before the Congress whose passage the country awaits with more thoughtful approval or greater impatience to see a great and admirable thing set in the way of being done."

In January, 1917, the bill passed the House, with amendments substituting the text of a somewhat similar bill previously introduced by Hon. D. M. Hughes of Georgia. After a period in conference for the adjustment of differences, the most important of which related to the composition of the administrative board, the status of home economics instruction, and the manner of providing the appropriations, a complete agreement was reached and the new law was signed by President Wilson on February 23, 1917.

As an expression of educational policy, the new act embodies some important departures from previous legislation. It makes provision for the training within the schools of a large group of our popula-

tion hitherto unreached directly by the Federal Government. On the one hand, by offering instruction along vocational lines and of subcollegiate grade, it supplements the Morrill Act, the expressed purpose of which is to maintain colleges "to teach such branches of learning as are related to agriculture and the mechanic arts . . . . in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life." On the other hand, since it contemplates a system of training in the schools, it also supplements the Agricultural Extension Act of 1914, in which the service provided is "the giving of instruction and practical demonstrations in agriculture and home economics to persons not attending or resident in state colleges in the several communities." Since it imposes definite requirements as to the training of teachers, it also represents a material extension of authority over the purely permissive provisions of the Nelson Amendment of 1907.

The principle of extending financial aid to education through the States rather than by direct appropriations to institutions is again adhered to, as is also that of requiring expenditures by the States or local communities on a dollar-for-dollar basis. The States may, however, if they desire, accept the benefits of the act only for agriculture or for the trades and industries, thereby receiving funds and assuming obligations accordingly. It would thus be unnecessary for States desiring federal appropriations only for vocational training in the trades and industries to maintain a system of vocational training in agriculture, or vice versa. This feature is of course quite different from the provisions of the Morrill Acts, which contemplate for each State the maintenance of instruction in both the mechanic arts and agriculture, and attempt no division of funds between the two branches.

The most radical innovation in the act deals with the method of its administration. Previous legislation along these lines has regarded the college of agriculture and mechanic arts as the state unit, whether for college instruction under the Morrill Acts and acts supplementary thereto, the preparation of teachers under the Nelson Amendment, the conducting of research in agriculture under the Hatch and Adams Acts, or the carrying on in cooperation with the U. S. Department of Agriculture of extension work in agriculture and home economics under the Extension Act. The administration of those measures dealing with college instruction has centered in the Department of the Interior, and of those dealing with research and extension work in agriculture in the Department of Agriculture. The vocational education act in both respects establishes a new administrative system.

As its head there is provided a Federal Board for Vocational Education. This board is to consist of seven members, including the Secretaries of Agriculture, Commerce, and Labor, and the U. S. Commissioner of Education, ex officio, with three members to be appointed by the President and confirmed by the Senate, ultimately for terms of three years each. One of the appointed members is to be a representative of the manufacturing and commercial interests, one of the agricultural interests, and the third of those of labor. The board is to select its own chairman each year.

The Federal Board is charged with the administration of the act, the details as to the care of funds, the certifying of the States, etc. in general plan resembling the legislation for the agricultural colleges and experiment stations. In addition it is empowered to make, or have made, investigations and reports to aid the States in the establishment of vocational schools and classes and in giving instruction in agriculture, the trades and industries, commerce and commercial pursuits, and home economics. These studies are to include agriculture and agricultural processes and the requirement upon agricultural workers, similar studies as regards the trades, industries, and commerce, home management, domestic science and the study of related foods, and the principles and problems of administration of vocational schools and of courses of study and instruction in vocational subjects. In the discretion of the board, the studies concerning agriculture may be made in cooperation with or through the Department of Agriculture. Similar cooperative arrangements may be made with the Departments of Labor and Commerce for industrial subjects, while the studies of the administration of vocational schools, curricula, and methods of instruction in vocational subjects may be taken up in cooperation with or through the Bureau of Education. An appropriation of $200,000 per annum, available from the date of passage of the act, is made to the board for its expenses.

To cooperate with the Federal Board in carrying out the act, each State when accepting its provisions is to designate a state board of at least three members. The state board of education or some board having charge of the administration of public education or of any kind of vocational education may be designated as the state board, or an entirely new board may be created.

The state board is to prepare plans for the approval of the Federal Board, showing the details of the work for which it is expected to use the appropriations. These plans, it is specified, must show the kinds of vocational education contemplated, the kinds of schools and equipment, courses of study, methods of instruction, and the qualifications and the plans for the training of the teachers and agricultural supervisors. In all cases the work must be conducted under public supervision and control.

The plans of expenditures for salaries in agricultural subjects must in addition show that the controlling purpose of the education is to fit for useful employment, that the training is less than college grade, and that it is designed to meet the needs of persons over 14 years of age who have entered upon or who are preparing to enter upon the work of the farm or of the farm home. The State or local community must provide the necessary plant and equipment, including a school farm or other farm for use in at least six months of supervised practice in agriculture per year, as well as contribute one-half the expenditure for the salaries of the agricultural teachers and supervisors, and bear the entire cost of all supplementary instruction.

The requirements are very similar as regards expenditures for salaries of teachers of trade, home economics, and industrial subjects, except that no provision is made for the federal payment of salaries of supervisors or directors in these branches. Practical work in these subjects is required for those not already employed, and there are also provided part-time classes in subjects "to enlarge the civic or vocational intelligence of workers over 14 and less than 18 years of age," and evening industrial schools which "confine instruction to that which is supplementary to the daily employment."

The training of teachers and supervisors is restricted to persons who have had adequate vocational experience or contact in the line of work for which they are preparing themselves, or are acquiring such qualifications as a part of their training. The federal appropriations for teacher training must be divided among agricultural, trade and industrial, and home economics subjects, no one of these subjects being granted more than 60 nor less than 20 per cent of the State's allotment for that year. After June 30, 1920, federal appropriations for salaries in either agriculture or in the industrial subjects can not be utilized unless the State is providing for teacher training in these lines.

The federal appropriations to the States are divided into three distinct groups, providing respectively for the payment of salaries of teachers, supervisors, or directors of agricultural subjects; for the payment of salaries of trade, home economics, and industrial subjects; and for the preparing of teachers, supervisors, or directors of agricultural subjects, and of teachers of trade and industrial and home economics subjects. The allotment in each of these groups begins with the fiscal year ending June 30, 1918, the amounts increasing for several years to a permanent maximum.

The main initial appropriation for salaries in agricultural subjects is $500,000. This is increased by $250,000 per annum during the next six years and then by $500,000 per annum during the next two years, making an appropriation of $3,000,000 for the fiscal year 1926 and

annually thereafter. Corresponding appropriations are made for the payment of salaries in the industrial subjects, but it is provided that no more than 20 per cent of these appropriations may be used for the instruction in home economics. The main appropriation for preparing teachers and supervisors is likewise \$500,000 for the first year, but increases to \$700,000 and \$900,000 respectively for the next two years and then becomes \$1,000,000 per annum thereafter.

The basis of allotment to the States also varies with the different groups. For salaries of the school instruction staff, the basis for each State is, for agriculture, the proportion which its rural population bears to the entire rural population of the country; for the industrial subjects, the corresponding proportions of the urban populations; and for the appropriation for preparing teachers and supervisors, the relative proportions of the total populations of the State and the Nation.

Provision is also made, however, whereby each State, regardless of its population, may receive at least \$5,000 per annum from each fund, and ultimately at least \$10,000. In order to provide this minimum allotment, small supplementary appropriations are granted, totaling for the entire country, when the system is in full operation, \$27,000 per annum for salaries of the agricultural instruction staff, \$50,000 for salaries of the industrial group, and \$90,000 for teacher preparation. Assuming that these sums are utilized in full and that the States accept the act in its entirety, the ultimate permanent appropriations under the act, including the maintenance fund for the Federal Board, may aggregate \$7,367,000 per annum.

As finally passed, this act embodies a system of federal and state administration of vocational education which is a compromise between the views of those who thought a separate system of public education should be organized for vocational purposes and those who believed that the unity of our present public school system should be maintained. While a separate Federal Board has been created it is closely linked with the Bureau of Education, which deals with the whole public school system. Each State is left free to establish a separate system or to make the vocational schools and courses a part of its existing system. It is therefore probable that different plans will be adopted in the different States, and that thus there will be many experimental efforts to solve the problems of vocational education.

Thus far, vocational education on a broad scale has been attempted only in the older countries, where class distinctions have made it comparatively easy to fix the industrial, and to a great extent the social, status of the youth at a comparatively early age. There it

has seemed best to organize the vocational schools on such a basis as would practically prevent the passage of students to institutions of higher learning. The needs of certain industries have been the paramount considerations in determining the courses of instruction in the vocational schools. Matters relating to the general education of the students for citizenship or for social life have in consequence been little regarded, and industrial efficiency has been almost the sole standard for measuring the results of the work of these schools. Without doubt much success on this basis has been attained, but it remains as yet an open question whether such education is a sufficient preparation for life in a free democracy. On the other hand there is danger that the traditional views and methods which have hitherto prevailed in our public school system may so influence the attempts to establish vocational education in this country that such education may be too amateurish and unpractical.

It is, therefore, probably very fortunate that so much flexibility of organization has been incorporated in this act. This broad measure, which will affect the educational system of our vast country with its great variety of industrial conditions and possibilities, gives an unequalled opportunity for the study and trial of curricula, methods of teaching, practical work, equipment, etc., adapted to a wide range of vocations and very diverse environments.

The training of the teachers provided for will throw a very heavy burden of responsibility on our higher technical institutions and particularly the land-grant colleges. These institutions have been very successful in training technical experts who have contributed in large measure to the success of our industries. They have not as yet paid any large attention to the training of teachers for secondary schools of the strictly vocational type. The pedagogy of this class of education is yet in its preliminary stages. It evidently will not do simply to copy what has been worked out abroad. There is therefore great incentive for men of original thought and inventive skill to enter this comparatively new field of teacher training. The colleges should offer inducements to able men to undertake this service, and use every proper means to build up strong educational departments along this line.

Since the Federal Board is charged with the approval of the plans proposed by the state authorities, as well as with the general administration of the measure, it is quite probable that the policies which the board may formulate will be an important factor in getting the new system of education under way. Opportunity is also afforded for the board to render constructive service of wide value through the educational studies for which provision is made.

At the time of writing, the appointive members of the Federal Board have not been announced, so that organization of this body

has not been affected. Acceptances of the act, however, are being considered in various States, and in a number the assent of the legislatures has already been obtained. For several reasons, it can hardly be expected that a system of this size and complexity can be put into complete operation immediately, and a program of gradual development is, indeed, contemplated in the increasing scale of allotments carried in the act itself. Progress under its provisions, however, seems likely to be awaited with unusual public interest, especially at this time when attention is being focused as never before upon all that pertains to agricultural and industrial efficiency as an element of national preparedness.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The chemical constitution of starch.—A review, A. W. THOMAS (*Biochem. Bul., 4 (1915), No. 14–15, pp. 379–397, figs. 4*).—This is a general review and discussion of the work on the constitution of starch. A list of 29 references to the literature cited is included.

Further notes on the essential oils of Australian Myrtaceæ (*Proc. Roy. Soc. Victoria, n. ser., 28 (1915), No. 1, pp. 149–156, fig. 1*).—Three papers are included.

I. *The essential oil of Eugenia smithii*, A. E. Dawkins (pp. 149–152).—The oil distilled from the leaves was of a pale yellow color and possessed a sweet, penetrating odor. The physical constants were determined in May, 1914, with the following results: Percentage yield, 0.44; specific gravity at 15° C., 0.866; optical rotation at 15°, +35°; refractive index at 20°, 1.4701. In July of the same year the following constants were obtained: Percentage yield, 0.28; specific gravity, 0.863; optical rotation, +34.6°; refractive index, 1.4675. The results indicate a slight seasonal variation. Chemical examination showed the oil to have the following percentage composition: *d*-α-pinene, from 80 to 90; esters, 4; and alcohols, 3.7.

II. *The calculation of the oil content of foliage from measurements of the number and size of the oil glands*, A. E. Dawkins (pp. 153, 154).—A formula for calculating the approximate yield of oil from oil-producing plants is submitted and its use described in detail.

III. *The essential oil of Eucalyptus platypus*, J. C. Earl (pp. 154–156).—A yield of about 1 per cent of oil was obtained by distillation of the fresh leaves. It yielded the following constants: Specific gravity at 15°, 0.9045; optical rotation at 12°, +9.1°; refractive index at 20°, 1.4675; saponification number, 6; saponification number after acetylation, 24; cineol determined by direct absorption with resorcin, 59 per cent by weight. No aldehydes or ketones were present.

Further examination revealed the following percentage composition of the oil: Pinene, from 20 to 25; phellandrene, from 10 to 15; cineol, from 55 to 60; aromadendrene, from 10 to 15; and alcohols, free and combined as esters, 5.

The distribution of nitrogen in coagulum and serum of Hevea latex on coagulation with acetic acid, B. J. EATON and F. W. F. DAY (*Agr. Bul. Fed. Malay States, 4 (1916), No. 11, pp. 350–353*).—As the rate of vulcanization of Hevea rubber depends on the amount of some substance formed by the decomposition of the nitrogenous constituents of the latex after coagulation of the rubber, the authors determined the nitrogen contents of the various portions after coagulation, finding in the latex 0.11, the wet coagulum 0.15, and the serum 0.06 per cent by weight. The significance of the results is discussed in some detail.

Silage and silage fermentation, A. R. LAMB (*Iowa Sta. Bul. 168 (1916), pp. 3–11*).—This is a general discussion of the subject under the following topics:

The fermentation of silage, cause of silage fermentation, soft corn ear silage, rape silage, other silage crops, and general precautions to be observed in the preparation of corn silage.

Philippine beeswax, H. C. Brill and F. Aggaoili (*Philippine Jour. Sci., Sect. A, 11 (1916), No. 1, pp. 15–18*).—The constants for a number of samples of Philippine beeswax, including the specific gravity at 15.5° C., melting point, saponification value, acid value, ester value, ratio number, iodin value (Hanus), unsaponifiable matter, and clouding point, are submitted in tabular form. Comparative analytical data of Japanese, Korean, and Philippine beeswaxes are also included.

The relation between the toxicity and the volatility of creosote oils, E. Bateman (*Jour. Indus. and Engin. Chem., 8 (1916), No. 12, pp. 1094, 1095, fig. 1*).

On the sulphonphthalein series of indicators and the quinone-phenolate theory, H. A. Lubs and S. F. Acree (*Jour. Amer. Chem. Soc., 38 (1916), No. 12, pp. 2772–2784*).

Some comparisons of methods for determining nitrogen in soils, W. L. Latshaw (*Jour. Indus. and Engin. Chem., 8 (1916), No. 12, p. 1127*).—The bumping during the distillation of ammonia in nitrogen determinations in soils was obviated by sufficient dilution of the mixture after the digestion. The heavy metals from the soils contained in the digest were considered to be the cause of the bumping, and it was found that where no mercury was used there was no bumping. The Gunning method proved satisfactory in respect to eliminating the bumping, but required considerable time for digestion, in some cases as much as four or five hours. The time of digestion, however, was reduced to an average of two and a half hours by the use of from 0.08 to 0.1 gm. of copper wire as catalyst.

The method for the determination of nitrogen in soils used at the Kansas Experiment Station is described in detail. Comparative analytical data show no marked differences between this method and the Official Method.

Total carbon in soil by wet combustion, C. J. Schollenberger (*Jour. Indus. and Engin. Chem., 8 (1916), No. 12, p. 1126*).—The author, at the Ohio Experiment Station, considers the wet combustion volumetric method of Ames and Gaither (E. S. R., 32, p. 805) to be capable of yielding results which compare very favorably with those obtained from furnace combustion and gravimetric determinations. The changes suggested in the procedure consist of the use of a mixture of phosphoric and sulphuric acids, instead of sulphuric acid alone, with chromic anhydrid as the oxidizing agent; the substitution of barium hydroxid for sodium hydroxid as the absorbent for carbon dioxid; and the replacement of the modified Camp absorption tube by Meyer's absorption apparatus or the bead tower described by Truog (E. S. R., 34, p. 504).

Comparative experimental data with the furnace combustion gravimetric procedure, the Parr method, and the old wet combustion volumetric method indicate the accuracy of the modified procedure.

Note on the results of analyses of fertilizer samples taken with different styles of samplers, F. B. Carpenter (*Jour. Indus. and Engin. Chem., 8 (1916), No. 12, pp. 1144, 1145*).—Some analytical data are submitted which show the great variation in results of samples taken by several individuals with various forms of samplers from the same lot of homogeneous material carefully prepared. A form of sampler which closes was found to give results on ammonia nearest to the theoretical amount.

The importance of uniform methods of sampling fertilizers is indicated.

The action of mineral acids on natural phosphate, A. V. Kazakov (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), Moskov. Selsk.*

Khoz. Inst., 10 (1914), pp. 38–50; Izv. Moskov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 22 (1916), No. 1, pp. 38–50).—The immediate transformation of natural calcium phosphate into the diphosphate by the action of small amounts of mineral acids was studied.

It is concluded that with the use of dilute aqueous or concentrated solutions of phosphoric acid or of pure or technical sulphuric acid there is a complete transformation into the dicalcium phosphate. The treatment with phosphoric acid yields a product which contains from 38 to 39 per cent of total phosphoric acid, 91 per cent of which is soluble. By the use of sulphuric acid the mixture of dicalcium phosphate and calcium sulphate obtained contains 23 per cent total phosphoric acid, 90 per cent of which is soluble.

Certain negative results were obtained in which the technical phosphoric acid did not decompose the phosphorite either into di- or monocalcium phosphate. This inactivity is being further studied.

On the decomposition of calcium phosphate by acetic acid, F. V. Chirikov and N. V. Khardin (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), Moskov. Selsk. Khoz. Inst., 10 (1914), pp. 104–114; Izv. Moskov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 22 (1916), No. 1, pp. 104–114).*—The authors studied the action of dilute acetic acid (2 per cent) on calcium phosphate. The transition of the phosphoric acid into the soluble state required 180 cc. of acetic acid in the case of $CaHPO_4$ and 540 cc. in the case of the $Ca_3(PO_4)_2$ for every gram of the salt.

Calcium carbonate lowers the amount of phosphoric acid soluble because it diminishes the amount of acid available for solution and also because of the introduction of a common ion. Sodium carbonate also lowers the P_2O_5 content in the solution, the effect of such action being even greater than that of the calcium carbonate. Calcium acetate diminishes the amount of P_2O_5 in the solution because of again introducing a common ion. The same effect is produced to a greater degree in the case of $CaHPO_4$ than in the case of Ca_3PO_4 by calcium nitrate.

Extraction of phosphoric acid from phosphorite, V. P. Kochetkov and N. P. Koblikov (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), Moskov. Selsk. Khoz. Inst., 10 (1914), pp. 12–15; Izv. Moskov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 22 (1916), No. 1, pp. 12–15).*—The authors have studied the influence of the quantity of sulphuric acid in regard to its concentration, the manner of moistening the phosphate, the temperature, the time of treatment, and stirring in the extraction of phosphoric acid from the natural rock. The data are submitted in tabular form.

Extraction of phosphoric acid from natural phosphates.—II, The influence of the construction of the stirring apparatus and its speed, A. V. Kazakov (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), Moskov. Selsk. Khoz. Inst., 10 (1914), pp. 1–11, figs. 13; Izv. Moskov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 22 (1916), No. 1, pp. 1–11, figs. 13).*—Continuing previous work (E. S. R., 34, p. 329), a detailed study of the various types of stirring apparatus in general use and the effect of the rate of speed on the extraction of the acid from mineral phosphates is described.

The Gatterman type of apparatus yielded the most satisfactory results. The effect of the speed was found to depend on certain variables, such as the absolute and relative dimensions of the stirrer, the capacity of the vessel containing the material which was being stirred, the viscosity of the mixtures, etc. It is indicated that the fixing of a definite rate of speed is simply empirical, and may be modified in accordance with the variables.

The preparation of phosphate precipitate, K. N. Shvetsov (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), Moskov. Selsk. Khoz. Inst., 10*

(1914), pp. 23–37; Izv. Moskov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 22 (1916), No. 1, pp. 23–37).—The author has investigated the conditions best suited for the precipitation of phosphoric acid by calcium carbonate. The results show that the procedure depends chiefly on the temperature and on the quantity and fineness of the carbonate used. The method of mixing, the mechanical stirring of the mixture, the concentration of the acid in the solution, and the temperature of the mixture during the reaction also influenced the composition of the final product.

The determination of phosphorus pentoxid after citrate digestion, O. C. SMITH (*Jour. Indus. and Engin. Chem., 8 (1916), No. 12, pp. 1127, 1128*).—A method of digestion in which a clear solution (the acid treatment) is easily obtained in an hour or less is described in detail by the author, at the Oklahoma Experiment Station.

On the composition and solubility of acid calcium carbonate, A. CAVAZZI (*Gaz. Chim. Ital., 46 (1916), II, No. 2, pp. 122–135*).—Experimental data show that by the action of carbon dioxid on an aqueous solution of calcium oxid or on neutral calcium carbonate the bicarbonate, $Ca(HCO_3)_2$, is formed.

The greatest quantity of calcium carbonate soluble (after prolonged agitation of not less than 10 hours) in 1 liter of water at 0°, saturated with carbon dioxid and maintained so at atmospheric pressure, was 1.56 gm., corresponding to 2.5272 gm. of the bicarbonate. Under analogous conditions at 15° C. 1 liter dissolved 1.1752 gm. calcium carbonate, equivalent to 1.9038 gm. of the bicarbonate.

By passing a rapid current of carbon dioxid through lime water saturated at 15°, the first turbidity formed after about one minute soon clears, and then a supersaturated solution of acid carbonate containing 2.29 gm. $CaCO_3$, equivalent to 3.71 gm. of the bicarbonate per liter, is formed.

The determination of water in plant substances, A. N. LEBEDIANTSEV and G. I. ZALYGIN (*Zhur. Opytn. Agron. (Jour. Agr. Expt.), 17 (1916), No. 3, pp. 181–230*).—In the determination of moisture in plant materials by heating to 100° C. in a current of air the authors observed a loss of carbon dioxid and certain other volatile organic substances. A loss of material through oxidation or hydration was thus indicated. Lowering the temperature of heating (from 80 to 60°), diminishing the pressure, or replacing the air with carbon dioxid did not perceptibly influence the loss of volatile matter other than moisture. The most important factor in the amount of loss was found to be the time of heating.

Drying in a desiccator with sulphuric acid or phosphorus pentoxid at normal temperature also caused a loss, the amount depending on the duration of the desiccation. An equilibrium, however, was reached in from four to seven months, so that the actual loss could perhaps be considered negligible.

The unreliability of the methods for the determination of moisture in plant materials commonly used and the necessity of specifying some standards when analytical data are submitted are indicated.

A method for the quantitative determination of free and combined galactose, A. W. VAN DER HAAR (*Chem. Weekbl., 13 (1916), No. 44, pp. 1204–1213, fig. 1*).—The following procedure for the determination of free galactose, which depends on its oxidation to mucic acid with nitric acid, is described:

A suitable sample (from 50 to 100 mg.) is treated in a beaker with 60 cc. of nitric acid (specific gravity 1.15) and heated on the water bath with occasional shaking until the material in the beaker weighs less than 20 gm. After cooling, water is added until the contents weigh exactly 20 gm. Five hundred mg. pure mucic acid is added and the whole set aside for 48 hours at 15° C., during which time the contents are occasionally agitated. The precipitated

mucic acid is then filtered through asbestos in a Gooch crucible, washed with nitric acid and water, dried, and weighed. From the weight of the material in the crucible the weight of the added mucic acid is subtracted, and the amount of galactose in the original sample is calculated.

For determining galactose in glucosids, a moisture-free sample of from 0.25 to 1 gm. is hydrolyzed with about 25 cc. of from 2 to 5 per cent sulphuric acid. After the hydrolysis is complete the material is allowed to stand for 24 hours, filtered, washed with water, dried, and weighed. The filtrate and washings are treated with dilute alkali until only slightly acid, and then concentrated on the water bath. After sufficient concentration the liquid is made alkaline and 30 cc. of the liquid oxidized with 30 cc. nitric acid (50 per cent). The procedure is then carried out as described above for the determination of free galactose. A curve and tables for converting milligrams of mucic acid to milligrams of galactose up to 1,000 mg. galactose are submitted.

Some analytical data submitted indicate the accuracy of the procedure.

A thermostat or constant-temperature cabinet for the flour-testing laboratory, C. H. Bailey (*Jour. Indus. and Engin. Chem., 8* (*1916*), *No. 12, pp. 1142–1144, figs. 5*).—The construction of a constant-temperature cabinet, used by the author at the Minnesota Experiment Station in baking and fermentation tests, is described. The thermo-element is so arranged that the cabinet can be used to cover a considerable range in temperature. The apparatus can be constructed at a nominal cost.

Investigation and determination of hydrocyanic acid in string beans (haricots), L. Guignard (*Ann. Falsif., 9* (*1916*), *No. 94–95, pp. 301–305, figs. 2*).—The preparation of a simple test paper for the detection of hydrocyanic acid in beans is described. The solution used contains 1 gm. picric acid in 100 cc. distilled water to which, after complete solution, 10 gm. crystallized potassium carbonate is added. The test is performed by hydrolyzing the pulverized sample in a suitable flask and suspending the paper in the neck of the container. The production of an orange-red color (after sufficient time is allowed for hydrolysis) indicates the presence of a cyanogenetic glucosid.

For the quantitative determination of hydrocyanic acid in imported beans the silver nitrate titration method with the distilled acid is used. This procedure is deemed to yield sufficiently accurate results.

The microscopic character of the bean (*Phaseolus vulgaris*) is also described.

Separation and identification of food-coloring substances, W. E. Mathewson (*U. S. Dept. Agr. Bul. 448* (*1917*), *pp. 56*).—This bulletin describes and discusses a scheme of analysis of dyes which embraces about 130 chemical individuals. The method of separation is based mainly on the use of immiscible solvents.

The general topics considered are reagents used in color analysis, preliminary treatment of food products, separation and purification of coloring substances, and identification of coloring substances. Tabulated data relative to the extraction of coloring substances from aqueous solutions by immiscible solvents, behavior of dry colors or of dyed fibers with reagents, behavior of colors when treated with reducing agents followed by oxidizing agents, classification of colors according to the reactions obtained by the bromin test, behavior of colors when treated with sodium nitrite and with cyanid solution, and the numbers by which dyes are designated in different published tables.

A modification of Price's method for the separation of the seven permitted coal tar dyes to include tartrazin, C. Estes (*Jour. Indus. and Engin. Chem., 8* (*1916*), *No. 12, pp. 1123, 1124*).—A slight modification of Price's method (E. S. R., 25, p. 502) for determining the permissible coal tar dyes, including

the recently admitted tartrazin, is described. A scheme for the separation of the dyes is included.

The determination of butter fat in margarins, G. Jorgensen (*Ann. Falsif., 9 (1916), No. 94–95, pp. 262–270*).—On account of the large amount of caproic and caprylic acids in palm and coconut oil the author considers the Reichert-Meissl number unreliable as an index of the amount of butter fat in margarins. The following procedure, in which the water-insoluble silver capronate and caprylate are precipitated as earlier suggested by Kirschner (E. S. R., 16, p. 1050) and Jensen (E. S. R., 17, p. 697), is described:

To the neutral liquid from the Reichert-Meissl determination 30 cc. of tenth-normal silver nitrate is added. The mixture is then made up to 150 cc., thoroughly agitated, set aside for one hour, and filtered through a folded filter. To 100 cc. of the filtered liquid 20 cc. tenth-normal sodium chlorid is added, and the excess sodium chlorid then titrated with standard silver nitrate, using potassium chromate as indicator. The number of cubic centimeters of silver nitrate used in the titration multiplied by 1.5 gives the amount of insoluble silver salts (A), corresponding to the soluble volatile acids. Designating the Reichert-Meissl number as B, the silver index is then equal to B-A.

Having the silver index and either the Polenske number or the total volatile acids, the percentage of butter fat in the sample is easily calculated by formulas which are submitted and described.

The method is deemed to yield results sufficiently accurate for practical work. A table giving the percentages of butter fat equivalent to the silver indexes obtained, together with the amounts of total volatile acids and Polenske numbers, is included.

A boiling method for the determination of water-soluble arsenic in lead arsenate, G. P. Gray and A. W. Christie (*Jour. Indus. and Engin. Chem., 8 (1916), No. 12, pp. 1109–1113*).—The authors, at the California Experiment Station, propose the following procedure:

Five-tenths gm. of the dry powder is placed in a 500 cc. Erlenmeyer flask, and after the addition of 200 cc. of distilled water boiled briskly for 10 minutes. If the liquid is cloudy or the material does not settle readily, it should be further digested on the steam bath for an hour or two. The material is filtered, washed with a small quantity of hot water, and the filtrate collected in a 500 cc. Erlenmeyer flask. One gm. potassium iodid and 4 cc. of concentrated sulphuric acid are added and the volume of the liquid reduced to 40 cc. by boiling. The liquid is then diluted to 200 cc., and the free iodin remaining titrated with approximately twentieth-normal sodium thiosulphate. The solution is nearly neutralized with concentrated sodium hydroxid, using methyl orange. Sodium bicarbonate is added to alkalinity and then to excess. The arsenic is titrated with a twentieth-normal iodin solution, starch paste being used as indicator.

The procedure outlined is considered to be shorter than any recommended heretofore, only three to four hours being required for an analysis. It yields accurate results, and its use is inexpensive.

The results obtained by the new procedure are higher than those obtained by the provisional method of the Association of Official Agricultural Chemists, but are deemed to be more nearly correct.

The methods in use at present are briefly reviewed and discussed.

An oxalate-iodid process for Paris green analysis, C. A. Peters and L. E. Fielding (*Jour. Indus. and Engin. Chem., 8 (1916), No. 12, pp. 1114, 1115*).—A method for the analysis of Paris green, in which the copper is precipitated as oxalate, the combined oxalic acid titrated with permanganate, and the arsenic oxidized in the filtrate by iodin, is described in detail from the Massachusetts

Agricultural College. The method is claimed to yield accurate results and, except for the fact that the copper oxalate must set overnight, is rapid.

The analysis, purification, and some chemical properties of agar agar, C. F. Fellers (*Jour. Indus. and Engin. Chem., 8 (1916), No. 12, pp. 1128–1133*).—The author, at the New Jersey Experiment Stations, discusses and reviews the literature on the sources, preparation, and composition of agar.

The results of the analysis of 16 samples of agar obtained from widely different sources show a remarkable uniformity. Considerably more nitrogen, however, was found in the samples than is usually considered to be present. A percentage ash constituent analysis of three samples is also submitted. A high ash or silica content is considered to be indicative of an inferior product.

A method of preparing a purified agar is described in detail. It consists essentially of washing the agar shreds in a solution of dilute acetic acid, washing out the acid, and precipitating while hot a 5 per cent solution of the agar by means of a large volume of alcohol or acetone. The greater part of the nitrogenous matter is removed by this method, and it is, therefore, recommended for the preparation of material to be used in refined bacteriological work, especially where a medium containing a minimum of nutrients is desired.

"Solutions of agar will solidify at all concentrations of HCl and NaOH between 4.5 per cent HCl and 5 per cent NaOH. Heating at one atmosphere pressure for 15 minutes in an autoclave narrows the range of solidification to from 2 per cent acid to 4.5 per cent alkali. Peptone increases the jellifying power of agar. KCl appears to decrease it slightly." The action of some other chemicals on agar is also noted.

Analytical methods used in sugar chemistry, E. Saillard (*Monit. Sci., 5. ser., 6 (1916), II, Nos. 897, pp. 193–203; 898, pp. 224–228*).—This article describes in detail and discusses methods for the determination of the density of sugar beets, sugar in beets by warm aqueous digestion, sugar by Clerget's inversion method, and invert sugar in the presence of saccharose.

The solubility of calcium sulphite in water and in sugar solution, T. van der Linden (*Meded. Proefstat. Java-Suikerindus., 6 (1916), No. 10, pp. 307–322*).—Tabulated solubility data submitted show that calcium sulphite is only slightly soluble in water and 15 per cent saccharose solution, but is more soluble in the latter than in the former. The solubility in either case varies inversely with the temperature. An excess of lime markedly diminishes the solubility in either solvent.

Data are also submitted on the solubility of calcium sulphite in 15 per cent saccharose plus 1.5 per cent glucose. They do not, however, differ markedly from the solubility figures in the pure saccharose solution.

The practical significance of such solubility data in sugar manufacture is indicated.

Sweet wines of high alcohol content without fortification, W. V. Cruess, E. M. Brown, and F. Flossfeder (*Jour. Indus. and Engin. Chem., 8 (1916), No. 12, pp. 1124–1126*).—In small-scale fermentations wines of over 18 per cent alcohol were made by the fermentation of grape must with wine yeast and the addition of grape sirup during fermentation. In one of these wines 19.9 per cent alcohol was obtained. The percentages of alcohol thus obtained are considerably higher than the maximum obtained by "straight" fermentation with the same yeast, and the higher yields are, therefore, considered to be undoubtedly due to the addition of the sirup.

Experiments made to determine the character of the invigorating compound of the sirup showed that it was not the sugar. The substance causing the increased activity of the yeast was not determined.

Partly dried grapes, used instead of the sirups, yielded the same results.

The wine made by the new method, if not filtered and carefully handled, was spoiled by the growth of "tourne" bacteria. When properly handled and kept in well-filled containers it kept well and developed an agreeable "sherry" flavor.

The preparation and conservation of fruit juices in the United States, A. TRUELLE (*Vie Agr. et Rurale, 6 (1916), No. 24, pp. 427–432*).—This article discusses general and special methods for the preparation and conservation of fruit juices, as devised and recommended by the U. S. Department of Agriculture (E. S. R., 33, p. 316).

The canning of fruits and vegetables, J. P. ZAVALLA (*New York: John Wiley & Sons, 1916, pp. XII+214, pl. 1, figs. 68*).—This volume discusses the processes, and data relative thereto, of factory fruit and vegetable canning, especially as practiced in California, micro-organisms and spoilage; and the making of sanitary cans. An appendix contining the Pure Foods Act of California, standards of purity, and the Food Sanitation Act, together with a rather complete table of weights and measures, is included.

The fruit-pulp industry, H. BLIN (*Vie Agr. et Rurale, 6 (1916), No. 35, pp. 149–154, figs. 6*).—This article discusses in detail the conservation of fruit by stoning and pulping. The economic importance of conservation by this method is indicated.

Honey vinegar, C. E. BARTHOLOMEW (*Iowa Yearbook Agr., 16 (1915), pp. 558–563, figs. 3*).—This article discusses the preparation of vinegar from surplus honey, especially the strong honeys which bring a low price on the market. A simple apparatus, easily assembled, for use in converting the alcohol into vinegar, and its manipulation, are described.

Meat preservation on the farm, J. C. MARSHALL (*Jour. Dept. Agr. Victoria, 14 (1916), No. 10, pp. 596–601*).—This article briefly describes methods for the preservation of meat by salting or pickling, sterilization by heat, and preservation by drying.

METEOROLOGY.

Daytime and nighttime precipitation and their economic significance, J. B. KINCER (*U. S. Mo. Weather Rev., 44 (1916), No. 11, pp. 628–633, figs. 10*).—Charts and diagrams showing in a general way the variations in diurnal distribution of rainfall for different sections of the country during the period from April to September, inclusive, are given and discussed. These show wide variations in the distribution of rainfall between day and night in different parts of the United States. The outstanding facts are the concentration of daytime rainfall in the Southeastern States and of night rainfall in the central plains States. It is shown that for portions of the Southeastern States only about 25 per cent of the total rain falls at night, while in the central plains district from 60 to 65 per cent or more occurs at night. There is a progressive decrease of the daytime rainfall in the Southeastern States toward the northward and westward. There is likewise a regular and progressive decrease in all directions of the night rainfall of the central plains States.

"The dominance of daytime rains in the Southeast and along the immediate Gulf coast is undoubtedly due to atmospheric convection during the warmer portions of the day, a characteristic of tropical and semitropical rainfall conditions, but just why there should be so well defined an area and so pronounced a type of night rainfall in the central plains region, with a progressive diminution in all directions, is not readily apparent." These are shown to be facts of great economic importance from the standpoint of farming. "In the Southeastern States, where the summer rainfall is usually abundant, the question of diurnal distribution so far as its bearing on the development of vegetation is concerned is not of so great importance." On the other hand, in the central

plains region where the rainfall is limited it is of great importance that the rains occur largely during the night, when they will do the maximum amount of good with the least interference with farm work, especially the harvesting and thrashing of wheat, which is the principal crop of the region.

Slope and valley air temperatures, W. R. Blair (*Reclam. Rec.* [*U. S.*], *8* (*1917*), *No. 1*, *pp. 40, 41*; *U. S. Mo. Weather Rev.*, *44* (*1916*), *No. 12*, *pp. 677–679*).—From a study of the results of three or four years' observations of mountain and valley temperatures in the vicinity of Mount Weather, Va., and by means of captive balloons at Lone Pine and Mount Whitney, Cal., the author concludes that "a little observation on the slopes of a given valley at the time of injurious frosts in the late and in the early autumn should serve to determine with sufficient exactness the height on the slopes above which, for some distance at least, the greatest freedom from such frosts will be experienced. The easiest and most direct way of making these observations is to expose thermographs at different altitudes on the slopes. The balloon is not needed because the upper surface of the cold-air mass in the valley is nearly level, possibly a few meters lower over the middle than at the sides of the valley. This upper surface has been found at 100 to 300 meters above the valley floor at different times of the night and in different localities."

Types of anticyclones of the United States and their average movements, E. H. Bowie and R. H. Weightman (*U. S. Mo. Weather Rev.*, *Sup. 4* (*1917*), *pp. 25*, *pls. 73*, *figs. 7*).—This paper is largely statistical, including, however, brief descriptions of the types of anticyclones which prevail in the United States, their courses, and the resulting weather and temperature conditions. No attempt is made to deal at length with theories concerning their origin, etc., further than to give "a statement of published views concerning the forces that originate, maintain, and propel anticyclones across the United States at a rate of speed that is little less than that of cyclones."

Graphic method of representing and comparing drought intensities, T. T. Munger (*U. S. Mo. Weather Rev.*, *44* (*1916*), *No. 11*, *pp. 642, 643*, *fig. 1*).—The construction and use of diagrams consisting of a series of right-angle triangles whose height and base are both proportional to the duration of the drought is described.

Frequency curves of climatic phenomena, H. R. Tolley (*U. S. Mo. Weather Rev.*, *44* (*1916*), *No. 11*, *pp. 634–642*, *figs. 4*).—The construction and use of such curves are discussed.

Monthly Weather Review (*U. S. Mo. Weather Rev.*, *44* (*1916*), *Nos. 11*, *pp. 611–669*, *pls. 9*, *figs. 17*; *12*, *pp. 671–712*, *pls. 13*, *figs. 4*).—In addition to weather forecasts, river and flood observations, and seismological reports for November and December, 1916; lists of additions to the Weather Bureau Library and of recent papers on meteorology and seismology; notes on the weather of the months; solar and sky radiation measurements at Washington, D. C., during November and December, 1916; condensed climatological summaries; and the usual climatological tables and charts, these numbers contain the following articles:

No. 11.—The Duration and Intensity of Twilight (illus.), by H. H. Kimball; Von Bezold's Description of Twilight; Mairan's Description of Anti-twilight; Explanations of the Western Purple Light and the Eastern Afterglow (Nachglühen), by A. Heim; Twilight Phenomena in Arizona, September to December, 1916, by A. E. Douglass; Twilight Colors at Mount Wilson, Cal., August-September, 1916, by W. P. Hoge; Solar Halo of September 28, 1916, at Miami, Fla. (illus.), by R. W. Gray; Metric System for Aeronautics; Measurement of Horizontal and Vertical Movement in the Atmosphere, by M. Tenani; Daytime and Nighttime Precipitation and Their Economic Significance (illus.), by J. B.

Kincer (see p. 717); Frequency Curves of Climatic Phenomena (illus.), by H. R. Tolley (see p. 718); Graphic Method of Representing and Comparing Drought Intensities (illus.), by T. T. Munger (see p. 718); Relation Between Strength of the Trade Winds of the North Atlantic and Temperature in Europe, by P. H. Gallé; Monthly Distribution of Mean Cloudiness Over France, by G. Bigourdan; Path of Sound Rays in Air Under Influence of Temperature, by V. Kommerell; and Six Years of Snowfall Measurements in the Carson, Walker, and Truckee Watersheds, by H. F. Alciatore.

No. 12.—Current Evaporation Observations by the Weather Bureau (illus.), by B. C. Kadel and C. Abbe, jr.; Slope and Valley Air Temperatures, by W. R. Blair (see p. 718); Low Pressure at Paris, November 18, 1916, by [C.] A. Angot; Thunder and Hail in the Paris Region, by [C.] A. Angot; The Kinetic Theory of Evaporation, by A. March; Temperature of the Ocean Below the 500-Fathom Line on the West Coast of America, by A. H. Clark; Surface Currents of Jupiter During 1915–1916, by S. Bolton; William Marriott, 1848–1916; Hurricanes of 1916 and Notes on Hurricanes of 1912–1915 (illus.), by R. H. Weightman; The Alabama Earthquake of October 18, 1916 (illus.), by R. H. Finch; Notes Relating to the Earthquake of October 18, 1916, in North-Central Alabama, by O. B. Hopkins; and Earthquakes Felt in the United States During 1916 (illus.), by W. J. Humphreys.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 3 (1916), Nos. 11, pp. 224, pls. 2, figs. 4; 12, pp. 226, pls. 2, figs. 5*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for November and December, 1916.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. Ostrander and W. P. Saunders (*Massachusetts Sta. Met. Buls., 337–338 (1917), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during January and February, 1917, are presented. The data are briefly discussed in general notes on the weather of each month.

[Meteorological observations], D. A. Seeley (*Ann. Rpt. Sec. Bd. Agr. Mich., 55 (1916), pp. 229–240*).—Daily and monthly summaries of temperature (maximum, minimum, and mean), precipitation, cloudiness and sunshine, and monthly summaries of pressure (maximum, minimum, and mean), wind movement, and miscellaneous phenomena (frost, hail, thunderstorms, fog, auroras, and halos) at East Lansing, Mich., are given for the year ended June 30, 1916.

SOILS—FERTILIZERS.

Measurement of the inactive, or unfree, moisture in the soil by means of the dilatometer method, G. J. Bouyoucos (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 6, pp. 195–217, fig. 1*).—This paper, prepared at the Michigan Experiment Station, deals with the dilatometer method as a means of showing the amount of water which becomes inactive in soils, as indicated by the amount that fails to freeze. "The principle of the dilatometer method is based upon the fact that water expands upon freezing. . . .

"The dilatometer consists of three parts: (1) a bulb, (2) a thermometer, and (3) a measuring stem. The method of procedure consists of mixing soil and water in certain definite proportions, placing this moist soil in the bulb, and then filling the latter with ligroin. The bulb with its contents is then placed in a cooling mixture and allowed to supercool. After the desired supercooling is attained the bulb is moved gently in the cooling mixture until solidification commences, which is indicated by the rise of the ligroin in the stem. The

bulb is allowed to remain in the ice mixture with frequent movement until equilibrium is reached. The total rise of the ligroin in the stem is taken to represent the total quantity of water that freezes in the soil.

"It was found that not all of the water added to soils freezes. Some of it fails to freeze, and the quantity that fails to freeze is different in the various classes of soil. Under the empirical conditions of 25 gm. of air-dry soil mixed with 5 cc. of water, supercooled to 3° C. in a temperature of —4°, the quantity that fails to freeze varies from 2 per cent in quartz sand to 80 per cent in clay, of the 5 cc. of water added. It increases, therefore, from the simple and noncolloidal types to the complex and colloidal types of soil.

"In the case of colloidal soils the amount of water that fails to freeze decreases with the increase in supercooling, but in the case of noncolloidal soils it remains the same. By increasing the degree of moisture content, the amount of water that fails to freeze is decreased in the colloidal soils, but remains practically the same in the noncolloidal soils. At the low-moisture content, successive freezings diminish the quantity of the unfrozen water in the case of the colloidal soils, but not in the noncolloidal soils.

"The percentage of water content that fails to freeze in all soils under the empirical conditions [stated] corresponds remarkably closely to the moisture content known as the wilting coefficient, to the percentage of moisture at which solidification can not be started, to the thermal critical moisture content, etc. . . .

"The dilatometer method appears to be of considerable value in showing (1) that soils cause water to become unfree, as indicated by its refusal to freeze; (2) in measuring quantitatively the amount of water thus becoming unfree; (3) in determining, under certain empirical conditions, the wilting coefficient of soils; and (4) in classifying, under certain empirical conditions, the water in the soil into free, capillary, physically adsorbed, and chemically combined."

The soil solution, how it is obtained, its composition and use in mechanical analysis by sedimentation, J. P. van Zyl (*Jour. Landw., 64 (1916), No. 3, pp. 201–275*).—Experiments with a tenacious clay soil on methods of obtaining the soil solution, and its composition and use in mechanical analysis, are reported.

It is concluded that methods hitherto used for obtaining soil solution, especially of heavy soil types, are either not permissible or are impracticable. The pressing out of soil (Auspressen) was found to be a good method for obtaining relatively large amounts of soil solution, especially from naturally very damp soil. The concentration of the soil solution was found to vary considerably not only for different soils but for different samples of soil from the same field. The variations in different soils were due for the most part to fertilization and climatic factors. The percentage composition of the soil solution in a heavy clay soil, on the other hand, remained approximately the same with different fertilization, which is attributed to the strong absorptive power of the soil.

Mechanical analysis with distilled water was found to be the best process for determining the absolute mechanical composition of the soil. The sedimentation process with soil solution was entirely different from that with distilled water. The influence of fertilization and time of year was marked, but the final results were similar to those obtained with distilled water.

It is concluded that the use of the soil solution will give a close indication of the momentary structure of cultivated soil.

Methods of mechanical study of soils, D. J. Hissink (*Arch. Suikerindus. Nederland. Indië, 24 (1916), No. 31, pp. 1204–1217*).—Several methods of mechanical analysis of soils are discussed.

Reconnoissance soil survey of the San Francisco Bay region, California, L. C. Holmes and J. W. Nelson (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 112, pls. 4, fig. 1, map 1*).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 2,517,120 acres in western California. "Topographically the area embraces a series of elongated valleys, separated by high hills or mountains, all extending in a general northwest-southeast direction. The valleys are somewhat irregular in outline and range in extent from a few square miles to about 200 square miles. They are usually well drained and consist of nearly level to very gently sloping surfaces with occasional minor stream bottoms."

"The soils of the valleys are principally recent alluvial soils. . . . Those of the hills and mountains are mainly residual and vary with the character of the underlying rocks. Much of the high mountainous area is too rough and broken for agriculture."

Forty-three soil types are mapped, of which the Altamont loam and clay loam and the Altamont, Mariposa, and Sites loams and clay loams cover 20.9 and 20.1 per cent of the area, respectively.

Soil survey of Grant County, Indiana, L. A. Hurst, W. I. Watkins, W. E. Tharp, E. Hertenstein, and P. Middleton (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 36, fig. 1, map 1*).—This survey, made in cooperation with the Indiana Department of Geology, deals with the soils of an area of 263,680 acres in northeast central Indiana, which consists of a level to undulating plain broken only along the streams. "Artificial drainage has been installed extensively in the more poorly drained sections of the county."

In addition to muck and peat, nine soil types of six series are mapped, of which the Clyde silty clay loam, Crosby silt loam, Miami silty clay loam, and Miami silt loam cover 34, 20.3, 18.5, and 14.5 per cent of the area, respectively.

Soil survey of Starke County, Indiana, E. J. Grimes, W. Barrett, and T. M. Bushnell (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 42, fig. 1, map 1*).—This survey, made in cooperation with the Indiana Department of Geology, deals with the soils of an area of 197,120 acres in northwestern Indiana, the topography of which is very flat except for scattered dunelike ridges and irregular areas of sand. "The county lies almost entirely within the Kankakee plain. . . . Practically all the flat lands throughout the county originally were poorly drained. . . . A large total area is yet unreclaimed."

Including muck, 10 soil types of 6 series are mapped of which the Plainfield fine sand, Clyde fine sand, Clyde fine sandy loam, and muck cover 31, 17.4, 17.1, and 16.7 per cent of the area, respectively.

Soil survey of Sioux County, Iowa, E. H. Smies and W. C. Bean (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 37, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 489,600 acres in northwestern Iowa, the topography of which varies from undulating to sharply rolling. The surface is that of a broad loessial plain. Drainage is well established. The soils are grouped as loessial, glacial, terrace, and first bottom soils.

Excluding river wash and rough broken land, 9 soil types of 6 series are mapped, of which the Marshall silt loam covers 80.8 per cent of the area.

Soil survey of Ripley County, Missouri, F. Z. Hutton and H. Krusekopf (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 36, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 399,360 acres in southeastern Missouri, lying in the Ozark region.

The topography of the uplands varies from level to very hilly. "In general, the western part of the county, west of the Current River, is the more broken, and large areas are too rough and rocky to cultivate. The southeastern corner of the county is in the Mississippi lowland region. The western part of the county is thoroughly drained by the Current River and its tributaries, and the eastern and northern parts by the Little Black River and its tributaries. The drainage of the Mississippi bottoms is poorly established, there being numerous sloughs and abandoned stream channels."

The soils of the county are mainly of residual and alluvial origin, with a small area of loessial origin. Including rough stony land, 17 soil types of 9 series are mapped, of which the Clarksville gravelly loam, stony loam, and silt loam and Decatur gravelly loam cover 20.3, 19.8, 18.3, and 10.8 per cent of the area, respectivey.

Soil survey of Lamoure County, North Dakota, A. C. ANDERSON, F. Z. HUTTON, T. M. BUSHNELL, M. THOMAS, and M. E. STEBBINS (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 53, fig. 1, map 1*).—This survey, made in cooperation with the North Dakota Experiment Station and the Agricultural and Geological Survey and issued January 30, 1917, deals with the soils of an area of 729,600 acres in southeastern North Dakota.

The eastern and central parts are mostly undulating prairie, and the western part is gently rolling to hilly. "Surface drainage is not well established, but is in most places sufficient where assisted by percolation into the subsoil. . . . The soils of the county fall into four general groups—glacial, glacial-lake and river-terrace, river flood-plains, and eolian soils." Including rough broken land, 25 soil types of 10 series are mapped, of which the Barnes silt loam, the Barnes loam, and the Williams loam cover 51.9, 15.3, and 11.9 per cent of the area, respectively.

Soil survey of Cambria County, Pennsylvania, B. B. DERRICK, A. L. PATRICK, and D. C. WIMER (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 32, fig. 1, map 1*).—This survey, made in cooperation with the Pennsylvania State College and Experiment Station, deals with the soils of an area of 445,440 acres in southwest central Pennsylvania lying mainly in the Allegheny Plateau. The topography is uneven to hilly and even mountainous in places. All parts of the county are said to be reached by drainage ways.

The upland soils of the county are of residual origin and the rest of alluvial origin. In addition to rough stony land, 10 soil types of 5 series are mapped, of which the Dekalb gravelly loam, stony loam, and silt loam cover 41.7, 20.6, and 14.1 per cent of the area, respectively.

A soil survey of the proposed Palouse Irrigation Project, H. F. HOLTZ (*Washington Sta. Bul., 133 (1916), pp. 3–14, pls. 6*).—This survey deals with the general characteristics and agricultural value of an area of 103,000 acres in southern Franklin County, Wash. The topography is rolling. The survey was divided into seven areas, and mechanical and chemical analyses and determinations of the water-holding capacity were made of representative soil samples from each area.

Analyses of one hundred West Virginia soils, F. E. BEAR and R. M. SALTER (*West Virginia Sta. Bul. 161 (1916), pp. 36, fig. 1*).—This bulletin gives a preliminary statement regarding the most prominent soil series of West Virginia, together with the analyses of 100 representative soil samples chosen from certain sections of the State. The latter are taken to indicate that many of the soils analyzed are seriously deficient in phosphorus, nitrogen, organic matter, and lime, while most of them are fairly well supplied with potash.

It was found that 50 per cent of the soils analyzed contained less than 1,000 lbs. of phosphorus per acre to a depth of 6 2/3 in., over 40 per cent contained

less than 2,500 lbs. of nitrogen, and 90 per cent showed a lime requirement averaging over 1 ton of limestone per acre. Eighty per cent of the soils contained more than 20,000 lbs. of potassium per acre to plow depth.

Reconnoissance soil survey of northeastern Wisconsin, A. R. Whitson, W. J. Geib, C. Thompson, C. B. Post, A. L. Buser, L. R. Schoenmann, and A. E. Taylor (*Wis. Geol. and Nat. Hist. Survey Bul. 47 (1916), Soil Ser. 12, pp. 87, pls. 11, figs. 3*).—This survey, made in cooperation with the Bureau of Soils of the U. S. Department of Agriculture, deals with the soils of an area of 3,902,720 acres in northeastern Wisconsin, including Forest, Florence, Marinette, Oconto, Langlade, and Shawano counties. The surface features are characteristic of a glaciated region and the topography varies from level to rolling.

The soils are of glacial origin. Including peat, muck, and rock outcrop, 27 soil types of 11 series are mapped, of which the Kennan silt loam and fine sandy loam cover 22.9 and 10.9 per cent of the area, respectively, and peat 9.8 per cent.

Reconnoissance soil survey of north part of north-central Wisconsin, A. R. Whitson, W. J. Geib, T. J. Dunnewald, C. B. Post, W. C. Boardman, A. R. Albert, A. E. Taylor, L. R. Schoenmann, and C. Thompson (*Wis. Geol. and Nat. Hist. Survey Bul. 50 (1916), Soil Ser. 15, pp. 80, pls. 11, figs. 3*).—This survey, made in cooperation with the Bureau of Soils of the U. S. Department of Agriculture, deals with the soils of an area of 2,707,200 acres in north-central Wisconsin, including Vilas, Oneida, Price, and Iron counties, five townships of Ashland County, and six townships of Rusk County. The surface features are characteristic of a glacial region and the topography varies from level to rolling and hilly and broken.

The soils of the area range in texture from sands of low agricultural value to loams and silt loams. Twenty-eight soil types of nine series are mapped, of which those of the Kennan series are the most extensive.

Soil survey of Columbia County, Wisconsin, A. R. Whitson, W. J. Geib, G. W. Conrey, and A. E. Taylor (*Wis. Geol. and Nat. Hist Survey Bul. 49 (1916), Soil Ser. 14, pp. 84, pls. 5, figs. 3*).—This survey has been noted from the Field Operations of the Bureau of Soils of the U. S. Department of Agriculture for 1911 (E. S. R., 31, p. 513).

Soil survey of Jefferson County, Wisconsin, A. R. Whitson, W. J. Geib, O. J. Noer, and A. H. Meyer (*Wis. Geol. and Nat. Hist. Survey Bul. 48 (1916), Soil Ser. 13, pp. 78, pls. 4, figs. 3*).—This survey has been noted from the Field Operations of the Bureau of Soils of the U. S. Department of Agriculture for 1912 (E. S. R., 34, p. 322).

Notes on soils analyzed, B. C. Aston (*Jour. Agr. [New Zeal.], 13 (1916), No. 1, pp. 36–41*).—Chemical analyses of 44 samples of New Zealand soils are reported and discussed.

Soils and crops of Nova Scotia (*Ann. Rpt. Sec. Agr. Nova Scotia, 1915, pt. 3, pp. 206, figs. 40*).—This compilation includes the following special articles bearing on soils: Geological Formations and the Soils of Nova Scotia, Humus, the Most Important Element in a Fertile Soil, The Conservation of Soil Moisture, Farm Yard Manure, and Commercial Fertilizers, by M. Cumming; The Chemistry of Nova Scotia Soils in Relation to the Geological Formations, Chemical and Physical Characters of the Soils of Nova Scotia, and Lime in Relation to Agriculture, by L. C. Harlow; and Underdrainage, by B. H. Landells.

Terracing and drainage of hill soils by the "Kotak" system, G. F. J. Bleij (*Terrasseering en Draineering op Berggronden volgens het "Kotak" systeem. Surabaya, Java: Nederland.-Ind. Landb. Syndicaat, 1916, pp. 9*).—This is a paper presented at the General Dutch Indian Soil Congress, October, 1916.

Terracing and drainage to prevent erosion of Java hill soils used for the cultivation of tea and coffee are discussed, and the so-called "Kotak" system of terracing practiced is described. In this system small rectangular terraces are employed instead of long terraces with ditches. For coffee a terrace 12 ft. square, with one tree in the middle, is usually constructed, while for tea a terrace 8 ft. square, with four plants, is used. An open drain is placed at the foot of the terrace.

The importance of soil ventilation on the alluvium, A. Howard (*Agr. Jour. India, Indian Sci. Cong. No., 1916, pp. 46–52*).—The importance of soil aeration in preventing the yellowing of peach trees, in increasing and hastening the effect of green manuring, and in aiding the maturing of crops is discussed.

Notes on the presence of nitrates in orchard soils, J. H. Gourley and V. D. Shunk (*New Hampshire Sta. Tech. Bul. 11 (1916), pp. 3–31, figs. 9*).—Experiments on the effect of sod, tillage, and liming on the presence of nitrates in light orchard soil with very sandy subsoil are reported.

It was found that "the formation of nitrates is greatly reduced in a sod orchard and from a fertility standpoint is the first limiting factor." Stirring the soil readily increased the rate of nitrification and under a good system of tillage nitrates were usually present in excess of the needs of the trees. Lime also consistently increased nitrification. Moisture was not the limiting factor in the sod plats.

See also a previous note (E. S. R., 33, p. 44).

Some effects of oxygen and carbon dioxid on nitrification and ammonification in soils, J. K. Plummer (*New York Cornell Sta. Bul. 384 (1916), pp. 305–330, figs. 5*).—Experiments with Dunkirk clay loam soil on the influence of oxygen and carbon dioxid on ammonification and nitrification are reported.

It was found that vigorous nitrification takes place in sealed flasks as long as there is a supply of oxygen. Of the soil gases studied, oxygen was found to be the limiting constituent. "There is an optimum mixture of this gas (one containing from 35 to 60 per cent of oxygen) for nitrification." From the losses of oxygen from the gas mixtures, it is considered certain that there are other forms of oxidation than that caused by the nitrate bacteria.

A large quantity of carbon dioxid was produced when lime was used, amounting in some instances to nearly 20 per cent. The greatest production of this gas accompanied the point of maximum nitrification. Ammonium sulphate, when applied to the soil without the addition of lime, produced only slight increases in nitrification even after incubation for a period of 28 days. "The small quantity of carbon dioxid formed under such conditions would tend to indicate that ammonium sulphate, when applied to this soil alone, depresses the action of the carbon-dioxid-producing bacteria as well. Taking the results as a whole it can not be said that carbon dioxid has any material effect on nitrification so long as oxygen is present in the atmosphere. It is of little consequence whether the oxygen is diluted with the inert gas nitrogen or with carbon dioxid. When the supply of oxygen becomes limited and anaerobic conditions are produced, denitrification sets in and this continues until practically all the nitrates are destroyed. In no case with these experiments was the combined oxygen liberated in the elementary form during the processes of denitrification."

The results with the distillation method for the determination of ammonia showed that there is no optimum content of oxygen for the production of this compound. The results of all mixtures, except the very high concentrations of oxygen, were practically the same. It seemed to make little difference whether the soil readily increased the rate of nitrification and under a good system of dioxid. Under purely anaerobic conditions, caused by an atmosphere of pure

carbon dioxid, there was somewhat less ammonia produced than when oxygen was present at the beginning. Ammonia was formed in rather large quantities under such conditions. Nitrate determinations showed that nitrates are produced in ammonification tests even though the organic content is high and the period of incubation is short.

A list of 27 references to literature bearing on the subject is appended.

The cause of the disappearance of coumarin, vanillin, pyridin, and quinolin in the soil, W. J. ROBBINS (*Science, n. ser., 44 (1916), No. 1147, pp. 894, 895*).—It was found that when soil in pots was treated with coumarin, vanillin, pyridin, and quinolin separately at a concentration of 1,000 parts per million, the numbers of micro-organisms increased enormously after three months and after, in some cases, an initial decrease in numbers. Additions of the substances to sterile soils and to sterile soils inoculated with nonsterile soil showed that after two months' incubation the growth of wheat plants from sterile seed was not affected in the inoculated soils, but the toxic properties of the compounds were still evident in the sterile soil. These results are taken to indicate that the disappearance of the compounds was due chiefly to biological causes. In this connection three species of bacteria were isolated, one of which uses pyridin as a source of nitrogen, and one vanillin and one coumarin as sources of carbon.

The formation of soda in the soil, E. V. BOBKO (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), Moskov. Selsk. Khoz. Inst., 10 (1914), pp. 355–365, pl. 1; Izv. Moskov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 22 (1916), No. 2, pp. 115–125*).—Artificial zeolite washed with a solution of sodium chlorid yielded small but measurable quantities of soda, and the quantity of soda increased with the length of time of the reaction and with an increase of the amount of zeolite. If an excess of sodium salt was added the process of the formation of soda was depressed, but was restored when the washing was repeated.

Loss of fertilizers by leaching, S. E. COLLISON and S. S. WALKER (*Florida Sta. Bul. 132 (1916), pp. 20, figs. 5*).—Five years' experiments on the loss of fertility constituents in the drainage water of fertilized and unfertilized sandy soils in four large steel tanks previously described (E. S. R., 25, p. 117) are reported.

The authors conclude that under Florida conditions and with soil similar to that used in this experiment "newly cleared land when exposed to heavy rainfall soon loses much of its fertility through leaching. The fertility of the soil may be maintained by growing legumes and applying fertilizers. Much of the loss may be prevented by growing crops. The greatest loss of fertility from unfertilized soils occurs with the nitrogen, which leaches through in considerable quantities. Nitrification of the soil organic matter, thus changing the nitrogen to a form readily lost by leaching, proceeds rapidly in cultivated soils under Florida conditions.

"Phosphoric acid and potash are lost in small quantities from the unfertilized soil, since they are present largely in insoluble forms. Lime is lost in considerable quantity, thus bringing about an acid condition in the soil.

"When cultivated soils are fertilized with a complete fertilizer, the element lost in largest amounts by leaching is nitrogen. Nitrate of soda leaches more rapidly and in larger amounts than sulphate of ammonia or dried blood. Nitrate of soda should be used in small amounts at frequent intervals and usually as a top-dressing.

"Distribution of rainfall influences to a considerable extent the amounts of the fertilizing constituents which leach through. Soils similar to that used in this work have the capacity for fixing large quantities of phosphoric acid ap-

plied in the form of acid phosphate. Such soils have the capacity for fixing considerable potash, but this power is soon exhausted, and afterwards relatively large amounts of potash are lost through leaching."

[Use of manures in Germany], T. H. MIDDLETON (In *The Recent Development of German Agriculture. London: Bd. Agr. and Fisheries, 1916, pp. 36, 37*).—It is stated that "the chief immediate cause of the increased productivity of German soil is the increase in the use of artificial manures." Between 1890 and 1910 the total consumption of artificial fertilizers in Germany is stated to have risen from 1,600,000 to 6,000,000 metric tons. There was a tenfold increase in the use of potash and a threefold increase in the use of basic slag.

"The chief factor in developing the use of artificial manures in Germany was unquestionably a well-organized system of technical education. Investigation at the research stations established the precise uses of these manures; trustworthy advice was supplied by institutions, by peripatetic instructors, by technical leaflets, and by agricultural newspapers," and the farmer, even the backward peasant, brought his method into line with the instruction so given.

It is pointed out that Germany has the advantage not only of great deposits of potash salt but vast tracts of light soils specially benefited by potash manures, and hence very successful results have been secured from the intelligent use of such manures.

Some effects of soluble humus on the growth of plants, W. B. BOTTOMLEY (*Assoc. Franç. Avanc. Sci., Compt. Rend., 43 (1914), pp. 969, 970*).—This is a summary of a number of experiments made by the author with bacterized peat.

A vegetation experiment on the availability of nitrogenous fertilizers in an arid soil, C. B. LIPMAN and W. F. GERICKE (*Soil Sci., 2 (1916), No. 6, pp. 575–581*).—Vegetation experiments with barley on an arid sandy soil are reported which showed "the low-grade organic nitrogenous fertilizers and sulphate of ammonia to be far more available than dried blood. This confirms the values as to relative availabilities of these fertilizers obtained by laboratory nitrification method. Nitrates, and especially nitrate of calcium, are far less available in the soil than are the other fertilizers with the exception of dried blood, which is about equal to nitrate of soda but superior to nitrate of calcium.

"These data furnish further evidence in support of the proposal to adopt the nitrification method in some form for the determination of the relative availabilities of fertilizer and soil nitrogen and for determining the needs of a soil for available nitrogen."

A list of references to literature on the subject is given.

Ammonifiability versus nitrifiability as a test for the relative availability of nitrogenous fertilizers, C. B. LIPMAN and P. S. BURGESS (*Soil Sci., 3 (1917), No. 1, pp. 63–75*).—Ammonification and nitrification experiments with 22 soils, principally arid, and tested with dried blood, high-grade tankage, steamed bone meal, cottonseed meal, and fish guano, are reported. "The ammonifiability data gave the fertilizers in question the reverse position as to availability from those given them by the nitrifiability data."

It is concluded that "the ammonifiability data of fertilizer nitrogen in soils are not useful indicators of the nitrifiability data on the same fertilizers in the same soils. . . . The nitrifiability of a given form of nitrogen should be the most reliable laboratory criterion which we can employ. The laboratory results are now being confirmed by vegetation experiments. Hence there appears to be no reason against adopting nitrifiability as the criterion of availability of nitrogenous fertilizers, for purposes of arid soil conditions at least."

Eight references to literature bearing on the subject are appended.

Technological-chemical research on superphosphates, U. PRATOLONGO (*Ann. Chim. Appl. [Rome], 6 (1916), No. 3–4, pp. 59–112, figs. 4; abs. in Jour. Soc.*

Chem. Indus., 35 (1916), No. 20, pp. 1073, 1074).—A number of samples of superphosphate were examined chemically and with a petrographic microscope, and experiments were made on the conditions of equilibrium of the system, lime, phosphoric acid, and water at 75 and 100° C., and on the influence of various factors on the physical properties of superphosphate.

Contrary to the generally accepted view, the calcium sulphate present in superphosphate prepared from mineral phosphates usually existed mainly or entirely as anhydrate. Only in rare instances was it present chiefly or solely as the dihydrate. In bone superphosphate, on the other hand, the dihydrate was present more frequently. Monocalcium and dicalcium phosphates occurred usually only in the hydrate form, but the anhydrous salts were also sometimes present.

The physical properties of superphosphate are considered to depend chiefly on the amount of the liquid phase which is always present. The liquid phase is defined as the sum of the free water and the free phosphoric acid. Analyses of numerous commercial samples of superphosphate indicated that in general the best products in regard to dryness and friability are those in which the liquid phase is less than 15 per cent. Products containing from 15 to 18 per cent of liquid phase were still dry and friable, those containing 18 to 25 per cent were slightly moist and caked when compressed, while those containing more than 25 per cent of liquid phase were moist and caked readily.

A discussion of the technical preparation of superphosphate is also included.

The preparation of superphosphate from phosphorites, N. P. Koblikov (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), Moskov. Selsk. Khoz. Inst., 10 (1914), pp. 16–22)*.—A superphosphate containing 16.2 per cent of water-soluble phosphoric acid was prepared from Perm phosphorite and one containing nearly 12 per cent was prepared from Saratov phosphorite.

Causes that influence the solubility of slowly soluble phosphates in citric acid, A. Aita (*Ann. Chim. Appl. [Rome], 6 (1916), No. 3–4, pp. 119–131, fig. 1; abs. in Jour. Soc. Chem. Indus., 35 (1916), No. 20, p. 1074)*.—Experiments are reported which showed that the solubility of the phosphoric acid of mineral phosphates in 2 per cent citric acid was diminished in the presence of sodium silicate or magnesium silicate, but increased in the presence of ferrous sulphate or manganous sulphate in proportion to the concentration of the latter. In the presence of ferric sulphate, ferric chlorid, or aluminum sulphate the solubility increased more rapidly than the concentration of the added salts. It is considered probable that the phosphoric acid of basic slag is present as tricalcium phosphate, and that its relatively high solubility in citric acid is due principally to the effect of the aluminum and ferric ions present. From this, it follows that the difference in price between the phosphoric acid of basic slag and of mineral phosphates is not justified, and that the Wagner citric acid test can not be considered satisfactory since it does not take into account the influence of secondary constituents on the solubility of phosphoric acid.

Valuation of water-soluble v. citrate-soluble phosphoric acid, E. J. Pranke (*Jour. Indus. and Engin. Chem., 9 (1917), No. 1, pp. 54, 55)*.—This is a critical review of reports from the New York, New Jersey, and New England state experiment stations in which the author attempts to show that the higher trade valuation for water-soluble phosphoric acid over citrate-soluble phosphoric acid is unwarranted. He points out that "the retail cost of 'available' phosphoric acid in acid phosphate decreases as the proportion of water-soluble to citrate-soluble increases. At present valuations for total phosphoric acid the organic phosphates cost actually more per unit of citrate-soluble than does the available in acid phosphate. Agricultural considerations are ruled out by definition from any connection with trade values, which are only market quotations."

The Garrison and Philipsburg phosphate fields, Montana, J. T. PARDEE (*U. S. Geol. Survey Bul. 640-K* (*1917*), *pp. 195–228, pls. 2, figs. 3*).—This is a report of an investigation of two phosphate beds covering the northeastern part of Granite County and a small adjoining part of Powell County in southwestern Montana.

It is stated that "workable deposits of high-grade rock phosphate (containing 60 per cent or more tricalcium phosphate) occur in both the Garrison and Philipsburg fields. That in the Garrison field lies from 6 to 10 miles north of the town of Garrison and is easily accessible, and the portion considered as available to mining contains by estimate 97,000,000 long tons. . . . About one-third of the amount lies above the natural drainage levels, and much of the portion can be very readily extracted by means of adits driven along the phosphate bed."

[Biotite, phonolite, and similar mineral substances as sources of potash for plants], F. V. CHIRIKOV (T. C. TCHIRIKOV) (*Iz Resul't. Veget. Opytov Lab. Rabot* (*Rec. Trav. Lab. Agron.*), *Moskov. Selsk. Khoz. Inst., 10* (*1914*), *pp. 366–370; Izv. Moskov. Selsk. Khoz. Inst.* (*Ann. Inst. Agron. Moscou*), *22* (*1916*), *No. 2, pp. 126–130*).—Experiments are reported which indicate that biotite and muscovite, and rocks containing nepheline and biotite, are very good sources of potash for plants; on the other hand, orthoclase and other forms of feldspar contain potash in a very unavailable form. Ammonium salts which increase the availability of phosphorites do not give like results with the slightly soluble potash minerals. The potash of artificial zeolite, which is very available in solutions containing salts of other bases, becomes almost unavailable if the possibility of exchange of the potash of the zeolite and other bases is removed. The effect produced by various potash minerals on plants is proportional to their power of exchanging potash with other bases.

Blast-furnace slag as a source of bases for acid soils, J. W. AMES (*Mo. Bul. Ohio Sta., 1* (*1916*), *No. 12, pp. 359–362*).—Pot experiments are reported, the results of which are taken to indicate "that furnace slag is not as efficient as limestone or lime. The use of slag as a substitute for either on acid soils is not recommended in any other than an experimental way. To obtain the same effect on acid soils as would result from moderate application of lime or ground limestone, a much larger amount of slag would be required."

The fertilizer value of city waste.—I. The composition of garbage, W. J. O'BRIEN and J. R. LINDEMUTH (*Jour. Indus. and Engin. Chem., 9* (*1917*), *No. 1, pp. 49–54*).—Analyses of 75 samples of garbage taken at regular intervals throughout a year in the District of Columbia showed that there was an unimportant seasonal variation in the moisture content, the maximum falling in July and the minimum in April. "This seems to be a product of a seasonal change both in diet and rainfall. It fails to show that it is of sufficient magnitude seriously to affect the commercial success of a garbage-rendering plant.

"The analysis of 128 samples of garbage taken from 16 sections, of known characteristics, of the city through a range of time of four or five months failed to show any marked or consistent variations. The conclusion is indicated that the kitchen refuse from the establishments of the various classes of inhabitants is essentially alike in content of fats and the elements of fertilizer value. This is without regard to relative quantities. Its importance lies in the fact that it tends to refute the prevalent opinion that the garbage of certain cities can not be rendered profitably because of the nature of its inhabitants."

Commercial fertilizers, 1916, C. D. WOODS ET AL. (*Maine Sta. Off. Insp. 80* (*1916*), *pp. 137–196*).—This bulletin contains the results of actual and guarantied analyses of 1,112 samples of fertilizers and fertilizing materials collected for

inspection in Maine during 1916. It was found that on the whole the fertilizers analyzed were well up to the guaranty.

Analysis of fertilizers for 1916, B. E. Curry and T. O. Smith (*New Hampshire Sta. Bul. 179 (1916), pp. 10*).—This bulletin contains the results of actual and guarantied analyses of 140 samples of fertilizers and fertilizing materials collected for inspection in New Hampshire during 1916. It is stated that a little less than half the brands inspected carried 1 per cent of potash.

AGRICULTURAL BOTANY.

Experimental studies in the physiology of heredity, F. F. Blackman et al. (*Abs. in Rpt. Brit. Assoc. Adv. Sci., 85 (1915), pp. 233, 234*).—This is the report of a committee of the association, giving a summary of the work being carried on by R. P. Gregory and H. B. Killby, by the latter alone, by Miss Gairdner, and by Edith R. Saunders (E. S. R., 34, p. 822).

The studies on the genetics and cytology of the tetraploid races of *Primula sinensis* have been continued, and progress has been made in the recognition and testing of the heterozygous types *AAAa*, *AAaa*, and *Aaaa*. The phenomena of coupling and repulsion have been further studied in both the diploid and tetraploid races.

The work has been continued on beans and vegetable marrows, on wall flowers and Tropæolum, and on foxgloves and stocks. In case of the last named, it appears possible to show how an ever-sporting type may be synthesized from a true breeding individual. Further progress has been made in the study of the inheritance of the half-hoary character and in the identification of theoretical types not found in commercial material. Evidences indicate that excessive percentages of doubles quoted by growers are due to unconscious selection and that the actual output of doubles is not in excess of that required by theory.

The calculation of linkage intensities, R. A. Emerson (*Amer. Nat., 50 (1916), No. 595, pp. 411–420, fig. 1*).—Discussing the methods in use for estimating the intensity of linkage, the author presents formulas for use in the approximation of gametic ratios directly from the F_2 data, without the use of coefficients of association and without respect to whether coupling or repulsion is involved. A single formula leading to accurate results in either case is given, together with others developed from this fundamental formula.

Morphology and evolution of leaves, O. F. Cook (*Jour. Wash. Acad. Sci., 6 (1916), No. 15, pp. 537–547*).—The author, discussing the primitive function of leaves and the course and results of specialization in the variously related structures, states that leaves of angiosperms show a primary division into a basal sheath and an expanded blade supported thereby, as represented in leaves of palms, grasses, and other plants. The organs usually described as petioles appear to have arisen through the narrowing of the base of the blade or the primitive sheath. The name foot is suggested as appropriate for the specialized portion of the leaf sheath that serves as a petiole, both petiole and foot being represented in several families named. The author considers also as specializations of the primitive sheath element such structures as stipules, bud scales, bracts, ligules, pulvini, and probably even the blade itself.

Preliminary observations on the nature and distribution of the statolith apparatus in plants, Miss T. L. Prankard (*Abs. in Rpt. Brit. Assoc. Adv. Sci., 85 (1915), p. 722*).—Statoliths, or bodies free to fall within the cell (statocyte) which contains them, are found in various forms in different parts of plants throughout a wide range of classification. These bodies are not universally connected with the presence of starch. Statoliths are often chloroplasts and

for this form the term chlorostatoliths is proposed. Statoliths may be specialized in shape, size, or behavior of the nucleus.

The statolith apparatus consists of the whole system of statocytes occurring in the various tissues of the plant, or else of cells themselves forming a tissue, for which the term statenchyma has been proposed. Modifications and transitional forms occur. The statolith is considered by the author as an intensive mechanism, the simplest form of statocyte being the living cell itself, the highest a cell containing relatively heavy bodies differentiated as to size and mobility. Between these extremes occur may transitional stages.

The influence of gaseous pressure on growth, ETHEL McCLENNAN (*Proc. Roy. Soc. Victoria, n. ser., 28 (1916), No. 2, pp. 245–250*).—Seedlings of *Pisum arvense*, observed while growing in a moist atmosphere at different air pressures, showed retardation usually in one day, the amount of retardation corresponding somewhat to the pressure. The plant accommodates itself to the pressure and the growth rate gradually rises. The mechanical effect of pressure upon turgor appears to be negligible as a factor determining growth. The influence in this connection of an increase in the oxygen dissolved in the tissues has not been determined.

Concerning the transformation of pigments of plastids in (the) living tissues of plants, V. N. LI͡UBIMENKO (LUBIMENKO) (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd), 6. ser., 9 (1915), No. 10, pp. 933–935*).—This is a preliminary report of the results of investigations which will later be published in detail.

The author states that all the transformations of pigments of plastids in the living tissues of plants are determined by the activities of oxidizing and reducing enzyms of the cell protoplasm, and the accumulation of a given pigment depends on the relation between the energy of oxidizing and reducing reactions in the cell. Particularly, the quantity and accumulation of chlorophyll in plastids in the presence of normal food supply is determined by the intensity of oxidizing reactions in the cell. This also explains the connection between greening and temperature.

Light does not play a direct part in the chemical transformation of leucophyll into chlorophyll, nor is there a direct correlation between the quantity of chlorophyll and the energy of growth. The author emphasizes the presence of a special enzym in the juices of the green plants provisionally termed by him antioxidase. It paralyzes the oxidizing action of peroxidase on the pigments of plastids and, unlike peroxidase, is highly sensitive to antiseptics. Morphological differentiation of the organisms of the higher green plants, it is said, is accompanied by their physiological differentiation in the sense of different intensity of oxidizing reactions. From the physiological viewpoint, plastids show a considerable independence with regard to the cell protoplasm and may be compared with leucocytes in animal bodies.

Concerning the mechanism of photosynthesis, A. A. RIKHTER (RICHTER) and E. M. KOLLEGORSKAI͡A (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd), 6. ser., 9 (1915), No. 5, pp. 457–467*).—A new method for quantitative studies of photosynthesis is described by the authors, in which a specially constructed apparatus and cultures of *Photobacterium italicum* were made use of. They come to the conclusion that plants differing in their ecological relations require the same initial intensity of light for the decomposition of carbon dioxid. It is noted, however, that with those plants which are enabled to concentrate light by means of special anatomical arrangements the intensity of light necessary for the separation of oxygen in photosynthesis may be much lower than with plants lacking such arrangements.

The distribution of reducing sugar in beets, H. Pellet (*Bul. Assoc. Chim. Sucr. et Distill., 33 (1916), No. 7–9, pp. 161–169*).—It is stated that the proportion of reducing sugars in beet root is nearly the same in the middle as in the upper and lower portions, and in the yellowed as in the normally colored beets of the same field. However, the proportion varies from time to time and may be small in mature roots.

Studies upon the maturity of grains, I, A. Blagovieshchenskiĭ (Blagoveščenskij) (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd), 6. ser., 10 (1916), No. 6, pp. 423–434, fig. 1*).—This investigation deals with synthetic reactions which take place in maturing seeds and ultimately lead to the formation of certain higher compounds, such as proteins, starch, and cellulose. The horse bean (*Vicia faba minor*) was selected for these studies for the reason that it contains approximately equal amounts of proteins and starch and very little fat. The analyses of the contents were made at several different stages of maturity, and the results are given in detail.

The ash content showed an increase in absolute quantity and a decrease in percentage. The same phenomenon was observed with the general amount of nitrogen. Starch, on the contrary, steadily increased both absolutely and relatively as the process of ripening advanced. The same changes occurred in the amount of cellulose.

It was noted also that similar synthetic reactions take place in the seeds during their ripening under artificial conditions—that is, after they are separated from the mother plant.

[Report of the research assistant in plant physiology], R. P. Hibbard (*Michigan Sta. Rpt. 1916, pp. 274–276*).—In connection with his studies on the absorption of solutes, with special reference to balanced solutions, the author found in water cultures with wheat and peas that a solution containing only potassium phosphate, calcium nitrate, and magnesium sulphate produced as good results the first five weeks of growth as where additional salts were used. The effect on photosynthesis in corn and cucumber plants of a nutrient solution lacking a single element has also been studied, and it is claimed that the amount of photosynthate in leaves can not always be taken as an indication of vigor.

On the interpretation of the results of water culture experiments, W. Stiles (*Ann. Bot. [London], 30 (1916), No. 119, pp. 427–436*).—This is mainly a discussion of the differences between the results and conclusions arrived at by the author in a previous contribution (E. S. R., 33, p. 223) and those offered by Miss Brenchley (E. S. R., 35, p. 436).

The effect of vanillin and salicylic aldehyde in culture solution and the action of chemicals in altering their influence, J. J. Skinner (*Plant World, 19 (1916), No. 12, pp. 371–378, figs. 3*).—In the experiments reported, the effect of vanillin on the growth of cowpeas and on the absorption of nutrients from the solution and the action of manganese in altering the effect of vanillin and salicylic aldehyde were studied.

In the first series of experiments, vanillin was shown to be detrimental to the growth of cowpeas, and the absorption of salts was also less from the solutions containing vanillin than from the controls without that compound. Considering all the cultures, the phosphate absorption was reduced 21 per cent, the nitrate 10, and the potash 33.

In studying the effect of manganese on vanillin and salicylic aldehyde, wheat seedlings were employed. It was found that the harmful action of these substances was partially overcome by manganese, even when this was present in small amount.

Antagonism between manganese and iron in the growth of wheat, W. E. Tottingham and A. J. Beck (*Plant World, 19 (1916), No. 12, pp. 359–370, figs.*

2).—The authors report on a study of the effects of equimolecular proportions of manganous and ferric chlorids on the growth of two varieties of wheat plants in water cultures. Knop's solution was used as the culture medium, and two concentrations were employed of each salt, $\frac{M}{1,000}$ and $\frac{M}{100,000}$. The study was limited to the antagonistic relations between manganese and iron in the belief that the chlorotic effects due to manganese might indicate interference with the rôle of iron in the production of chlorophyll.

Attention is particularly called to the prevalence of the toxic effect of manganese over iron at the low plane of supply. It is shown that for the growth of roots even the low plane of manganous chlorid is toxic. When the higher concentrations were used, ferric chlorid exerted stronger effects than manganous chlorid upon the growth and color of the varieties of wheat.

Electromotive phenomena in plants, A. D. Waller et al. (*Rpt. Brit. Assoc. Adv. Sci., 85 (1915), pp. 218–226, figs. 2*).—This is a committee report of studies by A. D. and A. M. Waller, regarding investigations of the electrical measurement of the vitality of vegetable tissues. In pursuance of experiments described in a previous report (E. S. R., 32, p. 522), the authors have endeavored to estimate the relative vitality of the plumules and radicles of seedlings by measuring the voltage of the blaze currents excited by single induction shocks, employing for this purpose seedlings of *Hordeum vulgare*. Tests were applied to the separated plumule and the radicle respectively on the fourth and on the sixth day of germination. The results are given in tabular detail.

Alterations of temperature are said to give rise to considerable alterations in the magnitude of blaze currents and of electrical conductivity, so these observations were made within the range of 18 to 20° C. The seeds must be soaked for a certain time before they will give off their full blaze current. The electrical response of a plumule of *H. vulgare* is of considerably higher voltage than that of a radicle. In consequence of excitation, the electrical resistance of a plant is diminished. The diminution is attributed to the chemical dissociation which has given to the blaze current. It is greater after strong than after weak excitation and the increased conductivity appears to be in relation with the magnitude of the previous blaze current.

The work during 1915 was intended to ascertain whether the blaze currents can be used as a practical test of the germination value of seeds. The result of such tests to peas are considered to show that an average blaze current of 0.03 or 0.04 volt indicate a high class seed, of which about 97 per cent would germinate, individual peas out of the series tested ranging in response from 0.01 or 0.02 to 0.07 or 0.09 volt. The electrical test is much quicker than the germination test and is thought likely to become a practical means to ascertain quickly the germination value of seeds in the market. The authors are still engaged in making tests on different varieties of seeds.

The effect of electrical stimulus on the permeability of plant cells, R. Koketsu (*Bot. Mag. [Tokyo], 30 (1916), No. 355, pp. 264–266*).—Experiments are briefly noted in which it is claimed to have been shown that, by the application of electrical stimulus, the plasma membranes of epidermal cells are rendered more readily permeable to dissolved substances.

The influence of defoliation on the development of sugar beet, H. Pellet (*Bul. Assoc. Chim. Sucr. et Distill., 33 (1916), No. 7–9, pp. 150–161, figs. 2*).—It is considered as proved, by the tests here described, that defoliation of beet influences the weight and sugar content of the root. This result is more marked as removal of the leaves is more frequent and more complete, the production of the new leaves thus drawing upon the materials in the root.

The effect of insecticides on flowering plants, A. F. SHREIBER (SCHREIBER) (*Trudy Bi͡uro Prikl. Bot.* (*Bul. Appl. Bot.*), *9* (*1916*), *No. 4, pp. 175, 176*).—The spraying of *Calendula officinalis* with a decoction of aloes and *Veratrum album* for the control of the cabbage moth (*Mamestra brassicæ*) is said to have shown no unfavorable effect on the flowers or the development of seeds.

Snow cracks on trees as an indication of the amount of bending, T. MAEKAWA (*Bot. Mag.* [*Tokyo*], *30* (*1916*), *No. 353, pp. 179–184, pl. 1*).—The author has recorded his observations on the effects of wind in cracking the ice and snow on the base, body, and branches of different species of trees during the progress of a violent snowstorm in Sapporo, Japan, February 24, 1915. The meteorological data for the period are also detailed in connection therewith.

The ecological significance of soil aeration, W. A. CANNON and E. E. FREE (*Science, n. ser., 45* (*1917*), *No. 1156, pp. 178–180*).—The authors report independent laboratory investigations on the relation of plant roots to the composition of the soil atmosphere and especially to a deficiency of oxygen or excess of carbon dioxid in this atmosphere.

Basing their conclusions upon these experiments, the authors consider it probable that soil aeration must be added as a factor of no less importance in plant growth than temperature and water. In many semiarid regions shallow basins without outlet occur, the central portions of which are flooded during the rainy seasons but are dry for most of the year. It is characteristic of these regions that they are void of plant life during most of the year and that no perennials are to be found in the lowest places, even where there is no excess accumulation of salts in the soil. It is suggested that the probable reason for the absence of plant life in such regions may be directly traceable to insufficient soil aeration at a time when the soil is suitably moist and at a temperature suitable for the growth of plants. About these playas are frequently observed well-marked bands or zones of plant life and it is thought that these represent the unlike response of the roots of the plants comprising the different zones to the atmosphere of the soil.

Distribution of the cacti with especial reference to the rôle played by the root response to soil temperature and soil moisture, W. A. CANNON (*Amer. Nat., 50* (*1916*), *No. 595, pp. 435–442*).—This is an examination of the evidence obtainable as drawn from various sources, one discussed at some length in this connection being the report of the Australian Prickly Pear Traveling Commission (E. S. R., 33, p. 134).

While soil moisture is an indispensible condition for the presence of cacti, temperature appears to be a very important limiting factor. Shallow placing of the roots subjects the plant to both high and low extremes of temperature and gives it access to the moisture resulting from very slight rainfall. An effective growth takes place only at relatively high soil temperatures when a certain but highly variable amount of moisture is present in the soil. The determination of the superficial position of the root system of cacti is thought possibly, from studies not yet published, to result from the plant's response to the oxygen supply of the soil.

Osmotic pressure in roots and leaves of plants with respect to the moisture contents of their habitats, V. S. IL'IN (ILJIN), P. S. NAZAROVA (NASAROVA), and M. K. OSTROVSKAI͡A (*Izv. Imp. Akad. Nauk* (*Bul. Acad. Imp. Sci. Petrograd*), *6. ser., 9* (*1915*), *No. 8, pp. 749–768*).—The authors have constantly observed a very close connection between the degree of osmotic pressure and the amount of moisture placed at the disposal of plant cells. They find that the higher the moisture content of the soil, the lower is the osmotic pressure in the roots. It is lower in meadow plants than in prairie (steppe) plants and still

lower in swamp plants. Osmotic pressure in the leaves is frequently higher than that in the roots and is not always correlated with the latter, but is determined by conditions of humidity.

Transpiration and assimilation in steppe plants, V. S. IL'IN (ILJIN) (*Izv. Imp. Akad. Nauk (Bul. Acad. Imp. Sci. Petrograd), 6. ser., 9 (1915), No. 4, pp. 346–367, fig. 1*).—The rates of transpiration and assimilation and their relationship in various prairie plants were studied and determined. Absolute quantities obtained at a given time and for a given amount of material were reduced to one hour per 1 gm. of dry weight and the amount of water which plants transpire for each cubic centimeter of decomposed carbon dioxid was calculated.

The results of 15 experiments were identical. They show that the plants adapted to a dry habitat are capable of a better usage of moisture and lose less water per unit of decomposed carbon dioxid than is the case with mesophytes. The mesophytes are uneconomical in the use of water and are compelled to close the stomata in order to lessen transpiration, thus considerably reducing or even completely checking assimilation, while in xerophytes under the same conditions these processes are going on at a normal rate. Mesophytes, however, under their normal moisture conditions, quite often lose less water than do xerophytes in their natural habitat, although the rate of transpiration of the former would rise to a high degree if they were transferred to the conditions normal for xerophytes.

With regard to water requirements and the ability to withstand drought, the author puts the steppe plants studied in the following order: *Stipa capillata*, *Centaurea sibirica*, *Phlomis pungens*, *Caragana frutescens*, *Centaurea orientalis*, and, possibly, *Amygdalus nana*, the first one being the most, and the last one the least resistant.

Teratological notes.—I, Abnormal seedlings, A. D. HARDY (*Proc. Roy. Soc. Victoria, n. ser., 28 (1916), No. 2, pp. 240–244, pl. 1*).—In this and papers to follow it is intended to record occurrences of interest to specialists in vegetable teratology which the author has observed within the past few years. The present paper discusses polycotyly, polyphylly, bifurcation of axis, cohesion of cotyledons, and other abnormalities. In future papers his purpose is to deal with heterotaxy and morphological deviations in foliage, etc., in older plants, particularly with reference to indigenous flora.

Identity of cohoba, the narcotic snuff of ancient Haiti, W. E. SAFFORD (*Jour. Wash. Acad. Sci., 6 (1916), No. 15, pp. 547–562, figs. 3*).—The results are given of a study of cohoba, a narcotic snuff which the aborigines of Haiti inhaled through a bifurcated tube for its intoxicating or hypnotic effects. The snuff hitherto thought by many writers to be a form of tobacco was in reality prepared from the seeds of the tree *Piptadenia peregrina*, resembling mimosa, which is widespread in South America and elsewhere. The intoxicating principle is at present unknown.

A fungus producing hydrocyanic acid and benzoic aldehyde, H. GUYOT (*[Trav.] Inst. Bot. Univ. Genève, 9. ser., No. 3 (1915), pp. 22–24, fig. 1*).—A fungus, supposed to be a new speces of Mucor, has been studied on different substrata. It produces considerable amounts of benzoic aldehyde and of hydrocyanic acid.

FIELD CROPS.

Report of division of farm crops, V. M. SHOESMITH and F. A. SPRAGG (*Michigan Sta. Rpt., 1916, pp. 285–292*).—Rotation and fertilizer experiments that have been in progress for the 5-year period 1911–1915 are briefly reported.

The investment of $5.73 in a complete fertilizer applied to wheat gave a crop increase for the rotation having a net profit of $13.51. The use of acid phosphate and muriate of potash showed a net profit of $12.79. Acid phosphate alone has given slightly better results than nitrate of soda and acid phosphate, and also than raw rock phosphate.

Large increases in yield of both corn and wheat from the use of manure are noted, together with the high values placed on the manure on the basis of these increases. The net value of yard manure per ton was estimated to be $2.68 and that of stall manure $3.15. By the addition of 200 lbs. of acid phosphate per acre the net value of stall manure was increased to $6.26 per ton after paying the cost of the fertilizer.

Results of top-dressing and plowing under manure for wheat indicated a value of manure for top-dressing of $5.54 per ton and when turned under of $6.15 per ton.

Further data are given showing the average yields and the average annual values of various crops grown continuously or in rotation for the purpose of determining the cost of producing them.

A general review of crop improvement work given by F. A. Spragg, includes notes on selection work with wheat, beans, peas, and alfalfa.

Investigations in inheritance of shape and size in beans are noted. The data obtained to date indicate a Mendelian segregation of one pair of characters in size inheritance, large size being dominant.

Individual alfalfa plants were observed setting new leaves on old stems that had been defoliated by leaf spot, the plants attaining maturity and setting seed. The progeny of the best of these plants is being propagated.

The extension to nursery work of methods involving the coefficient of yield previously described (E. S. R., 34, p. 735), is noted.

[Field crop experiments], F. WATTS (*Imp. Dept. Agr. West Indies, Rpt. Bot. Sta.* [*etc.*] *Antigua, 1914–15, pp. 5–20*).—Variety tests with sweet potatoes, cassavas, eddoes, tannias, yams, corn, and cotton are reported, as well as tillage experiments, distance-of-planting tests, fertilizer experiments, and plant breeding experiments with corn. The plant breeding experiments consist of selection work on local corn, acclimatization of imported varieties, and the propagation of new varieties. In cotton selection work a hybrid has been developed from a cross of Sea Island with St. Eustatius which gives much promise for the future. Brief notes are given on onions, soy beans, garden beans, and peas.

Report on field experiments, 1914, R. M. WILSON and J. H. SMITH (*Essex Ed. Committee, Rpt. Field Expts., 1914. pp. 3–34*).—This is a report of cooperative field experiments conducted in Essex for 1914, including variety tests with winter wheat, barley, oats, potatoes, mangels, corn, and peas, several experiments noted below, and some minor experiments with sorghum, alfalfas, and western-wolths grass.

It was found that a change of seed had considerable influence on the potato crop and that seed secured from Scotland gave the best results. Fertilizer tests with mangels indicated that nitrate of soda and acid phosphate increase the yields. Basic slag proved superior to acid phosphate on heavy soils. Marrow-Stem kale and kohl-rabi proved superior to the other green crops tested, due to their drought-resistant qualities. Some notes are given on the feeding value of different types of flax, together with a brief discussion of the cultivation and harvesting of the crop. Riga seed grown in Holland is recommended for planting. In fertilizer tests with pasture land applications of sodium nitrate gave better results than acid phosphate.

Fall-sown grains in Maryland and Virginia, T. R. STANTON (*U. S. Dept. Agr., Farmers' Bul. 786* (*1917*), *pp. 23, figs. 5*).—This discusses methods and

practices relative to the growing of fall-sown grains in Delaware, Maryland, Virginia, and West Virginia, with recommendations as to the best varieties of the various grains to grow, based on tests made with winter wheat (bearded and beardless), winter spelt and emmer, winter rye, winter oats, and winter barley.

Seed-flax production, C. H. Clark (*U. S. Dept. Agr., Farmers' Bul. 785 (1917), pp. 19, figs. 9*).—This discusses the methods and practices of flaxseed production in the United States, emphasizing not only the value of flax on new sod but also its possibilities in the older agricultural districts.

Flax varieties grown in the United States are roughly divided into (1) seed flax, (2) short fiber flax, and (3) textile fiber flax. In tests at 10 stations in the northern Great Plains area west of the Red River valley, where flax wilt is not serious, the seed-flax varieties have given uniformly better results than the short fiber flaxes. North Dakota No. 155, or some selection from it, has usually given the highest yield, while North Dakota Resistant Nos. 52 and 73 and similar strains have also proved excellent varieties.

In subhumid sections farther east, North Dakota Resistant No. 114 and Primost (Minnesota No. 25) have been widely distributed.

Tests with flax in a 6-year rotation of 3 years of alfalfa and 1 year each of corn, flax, and sugar beets in comparison with flax grown continuously have been conducted at the Belle Fourche and Huntley experiment farms (E. S. R., 33, p. 829; 36, p. 132). At Huntley the average yield of flax in the rotation for the first 4-year period was 25.8 bu., the highest yield being 31.3 bu. The average yield of continuously cropped plats was 10.1 bu., and the highest yield 14.5 bu. The yield of the continuously cropped field has increased each year.

Similar results were obtained at the Belle Fourche station. The 1914 flax plat in the 6-year rotation yielded 21.4 bu., while the yield of the continuously cropped plat was 7.5 bu.

A rotation similar to the above in the irrigated rotation series at the Scottsbluff experiment farm has not given as satisfactory results, due largely to unfavorable weather conditions. These tests are being continued.

Change of sex in hemp, F. J. Pritchard (*Jour. Heredity, 7 (1916), No. 7, pp. 325–329, fig. 1*).—The differences of opinion regarding the effect of external stimuli upon sex ratios led the author to undertake investigations with hemp in an effort to determine the following: (1) Can sex ratios of diœcious plants be altered by modifying conditions external to their germ cells? (2) Is the alteration thus obtained limited to individuals of one sex? (3) How do results harmonize with the Mendelian conception of sex determination?

The hemp plant was employed because it is almost wholly composed of distinctly unisexual individuals, although monœcious individuals (which were distinctly female in type) also appeared. The plant's physiological equilibrium was disturbed by the removal of flowers and other vegetative parts and by the injection of the following chemical substances into the stem: Calcium nitrate 0.1, zinc sulphate 0.1, dextrose 5, maltose 5, peptone 1, asparagin 0.5, potassium iodid 3 per cent, pyridin $\frac{n}{25}$, formic acid $\frac{n}{16000}$, acetic acid $\frac{n}{60}$, $\frac{n}{30}$, sodium hydrate $\frac{n}{300}$, $\frac{n}{100}$, $\frac{n}{60}$. Two hundred and sixty-three plants were mutilated by the removal of flowers, flower buds, leaves, and portions of the stem. The tops of 20 were bagged and 60 others received injections of the above-named chemicals. The discussion covers the results obtained from two years' experimental work.

Alteration of sex occurred under several different treatments, the removal of parts being the only factor, however, common to all the sex-developing responses.

Of the 163 plants which produce flowers after treatment, 29 developed some flowers of the opposite sex. Four of these plants were males and 25 females.

It is evident that the sex of hemp is alterable by the removal of flowers. Although only a few male plants produced pistils, they constituted from 14 to 21 per cent of the total number of males producing flowers after mutilation, while the females were very responsive to the stimulus of flower removal. In the second year's experiments every female mutilated produced stamens. These results seem to indicate that sex is not wholly a matter of zygotic constitution but that both males and females are potential hermaphrodites, as believed by Darwin and Strasburger.

Rice variety studies, E. van Drent (*Dept. Landb. Suriname Verslag, 1915, pp. 62–66*).—This is a brief account of some rice variety trials, including a study of the plat arrangement employed. Each of the five varieties tested were sown in three parallel plats, the planting distances being 0.5, 1, and 1.5 ft., respectively. Brief notes are given on the cultural characteristics of each variety with special reference to their resistance to wind. No conclusions as to the best distance for planting could be drawn, but the experiments will be continued in 1916 with two varieties, using the same system of plats, and from these it is hoped to obtain definite results.

[Sugar cane] (*Hawaii. Sugar Planters' Sta. Proc., 35 (1915), pp. 20–26, 64–80, 86–113*).—Progress in variety testing at the Waipio substation and in cooperative field tests is reported. Leguminous seeds are being distributed for the production of green manure crops. The most desirable crops for this purpose are san hemp and the Bengal bean. Reports of the committees on cultivation, fertilization, and irrigation on irrigated plantations and on cultivation and fertilization on unirrigated plantations are given, together with a discussion thereof.

Breeding sugar cane (*Jour. Heredity, 7 (1916), No. 9, p. 405*).—This is a brief note on sugar cane breeding in Porto Rico. Hand pollination has been found almost impossible, due to the smallness of the flower, the height at which the inflorescence is produced, and its brittleness. Wind pollination has been accomplished by planting a pollen-sterile variety on the leeward side of a pollen-fertile variety.

Studies in Indian sugar canes.—II, Sugar cane seedlings, including some correlations between morphological characters and sucrose in the juice, C. A. Barber (*Mem. Dept. Agr. India, Bot. Ser., 8 (1916), No. 3, pp. 103–199, pls. 32, figs. 2*).—This gives a detailed account of studies of sugar-cane seedlings.

In an effort to increase sugar production in India, sugar-cane seedlings have been propagated at Coimbatore in Madras, where the cane flowers profusely. The seedlings obtained are enumerated and described by periods, representing the periods of seed production. Variations in nine morphological characters, viz, vigor and size, general habit of growth, erectness of young shoots, tillering, leaf types, width of leaf, color of leaf, color of cane, and thickness of cane, and in the sucrose percentage in the juice are discussed in detail. A number of correlations between the morphological characters of the seedlings and the richness of their juice have also been studied. These correlations are as follows: Leaf width and sucrose, length of leaf and sucrose, leaf nodule and sucrose, thickness of cane and sucrose, length of cane and sucrose, cane module and sucrose, leaf width and thickness of cane, leaf width and total weight of seedling, leaf width and tillering, and color of cane and sucrose.

Production of sugar in the United States and foreign countries, P. Elliott (*U. S. Dept. Agr. Bul. 473 (1917), pp. 70*).—Statistics are given for the United States and 37 other countries on the production of cane and beet sugar for the period from September 1, 1903, when the Brussels Convention went into effect,

to the close of the sugar year 1912–13, with a comparison of the preceding decade.

The total world production of both beet and cane sugar increased from about 11,000,000 tons in 1893–94 to 20,000,000 tons in 1912–13. The average annual world output for the decade 1904–1913 was 16,419,000 tons, as compared with 11,498,000 tons for the preceding decade. The production of beet sugar for these two periods shows an increase of 34 per cent, while cane-sugar production increased 40 per cent. This latter increase was largely due to improved industrial conditions in Cuba, where alone an increase of 152 per cent was realized. An increase of 85 per cent was realized in Java.

It is estimated that over 12,000,000 acres are harvested annually to produce the world's sugar supply, this acreage being about equally divided between beets and cane. The yield of sugar beets per acre has varied from 1,800 to 3,900 lbs., while cane sugar has varied from 2,000 to 9,000 lbs. Hawaii and Java exceeded all other countries in the production of sugar per acre, amounting to 4.5 to 5 tons for some years in Hawaii. These countries also led in the production of cane, averaging about 40 tons per acre. The United States had the highest production of beet sugar per factory employee, so far as data are available, the output amounting to 59.8 tons annually as compared with 22.97 tons for Hungary, 20.61 for France, 13.95 for Austria, 11.42 for Russia, and 19.09 for cane sugar for Hawaii.

During 1904–1913 78.9 per cent of the world's output of sugar was produced in 11 countries, as follows: British India, 14.5; Germany, 13.6; Cuba, 10.3; Austria-Hungary, Java, and Russia, 8 each; United States and France, 4.7 each; Hawaii, 3; and Belgium and the Netherlands, 1.5 each.

Cuba exceeded all other countries in the exports of sugar for the last decade, while the United States exceeded all other countries in imports. The United States also led all other countries in the consumption of sugar, with an increase of 42.9 per cent over the preceding decade. During the decade 1904–1913 Australia exceeded all other countries in per capita consumption of sugar, amounting to 112.96 lbs.

Statistics for each country are discussed in detail.

Manuring of swedes with different phosphatic manures; purchase of basic slag (*Univ. Col. N. Wales, Bangor, Dept. Agr.* [*Pub.*], *6* (*1914*), *pp. 7*).—These experiments were begun in 1913 at eight centers in North Wales to determine whether basic slag should be purchased on the basis of total phosphorus or on the amount of phosphorus soluble in a 2 per cent citric acid solution and the comparative value of basic slag, acid phosphate, and mineral phosphate as a fertilizer for swedes on North Wales soils. The experiments are to be continued further, but the results obtained thus far indicate that basic slag will give as good results as acid phosphate if used in such quantities that the crop receives an equivalent amount of phosphorus soluble in 2 per cent citric acid, and that mineral phosphates, if finely ground, are to be recommended for swedes.

Manuring of swedes with different phosphatic manures (*Univ. Col. N. Wales, Bangor, Dept. Agr.* [*Pub.*], *6* (*1915*), *pp. 4*).—A continuation of the experiments noted above indicates that a liberal application of phosphatic fertilizers is essential for the production of swedes, and that basic slag and acid phosphate have produced the highest yields.

The suppression of characters on crossing, R. H. Biffen (*Jour. Genetics, 5* (*1916*), *No. 4, pp. 225–228*).—This article deals with the study of the association of the mouse-gray color occurring in the glumes of the Rivet wheat (*Triticum turgidum*) and the presence of a quantity of hairs on the glumes. It is offered as a contribution to the information by Bateson and Pellew (E.

S. R., 34, p. 41), in which it is shown that a group of characters introduced by one of the original parents failed to affect the F_2 generation.

The author has found that all gray-chaffed wheats are rough-chaffed, but that all rough-chaffed wheats are not gray. In the F_2 generation in crosses of Rivet wheat with Polish wheat (*T. polonicum*) having white glumes, over 2,000 plants raised from 20 separate F_1 crosses had the identical glume color of Polish wheat. Cases are cited where red-grained varieties, in which the parents bred true to color, when crossed produced white-grained varieties. The suppression of a dominant character in the F_2 generation, from parents showing dominant characters only, is thought to be more frequent in wheats than it appears to be at present. It is suggested that this suppression may be due to the existence of more than one determining factor for the dominant character (in this case, color), and that consequently two factors determining the recessive character may occasionally meet in the zygote, thus completely suppressing the dominant.

Work in connection with Egyptian wheat, G. C. Dudgeon and G. Bolland (*Min. Agr. Egypt. Tech. and Sci. Serv. Bul. 7 (1916), pp. 9*).—This bulletin outlines investigations being conducted with native and imported wheat at the Gheezeh School of Agriculture, together with a discussion of the results obtained thus far. The native types are of the Baladi variety. Imported seed from England, America, Russia, Cyprus, Australia, and Sudan, were sown between November 18 and December 1, 1914. These varieties were badly infested with rust and in 1915 only three native varieties and the Muzaffarnagar wheat of India were sown. Of these varieties the White Baladi gave the highest yield.

An experiment was also undertaken to determine the rate of seeding and the comparative value of plowing in and harrowing in the seed. The same variety was used in all tests, and a rate of 6 kelehs per feddan (2.5 bu. per acre) harrowed in gave the best results.

A series of experiments to determine the best method of treating seed for the prevention of smut included treatments with copper sulphate solutions varying in strength from 0.5 to 10 per cent and with Cyllin from 1:2,000 to 1:250. The results obtained indicate that all the treatments greatly reduced smut infection, but that the copper sulphate solutions stronger than 2 per cent and all the Cyllin solutions were too strong and reduced germination.

Carman's wheat-rye hybrids, C. E. Leighty (*Jour. Heredity, 7 (1916), No. 9, pp. 420–427, figs. 4*).—This is a comprehensive summary of the work of Elbert S. Carman, a former editor of the *Rural New Yorker*, in his attempts to establish a wheat-rye hybrid. The fact is brought out by the author that many of the supposed hybrids in the *Rural New Yorker* series show no trace of rye characters and that only one variety originated from a real wheat-rye hybrid. This variety, known as No. 6, is an actual descendant from the true wheat-rye hybrid obtained in 1883.

Seed reports, 1914, 1915, J. W. Kellogg and H. E. Gensler (*Penn. Dept. Agr. Buls. 258 (1915), pp. 35; 276 (1916), pp. 35, figs. 5*).—A report of the seed inspection for 1914 and 1915 is given. A copy of the seed law, directions for sampling seed, and the standards of purity used in seed testing are included in the report for 1914, while in that for 1915 100 noxious weed seeds found in farm seeds are described and illustrated.

Results of seed tests for 1916, F. W. Taylor and F. S. Prince (*New Hampshire Sta. Bul. 180 (1916), pp. 18*).—This reports the analysis of 84 samples of seed collected by the station during the year 1916, and other data.

Michigan weeds, W. J. Beal (*Michigan Sta. Bul. 267, 2. ed. (1915), pp. 181, figs. 248*).—This is a revised edition of a bulletin previously noted (E. S. R., 27, p. 343), following the American Code of Nomenclature in the second edition

(1913) of Britton and Brown's Illustrated Flora of the Northeastern United States and Canada as a standard for the botanical names.

Kill garlic and wild onion by oil spraying, A. D. SELBY and D. R. VAN ATTA (*Mo. Bul. Ohio Sta., 1 (1916), No. 12, pp. 355–358, figs. 2*).—The eradication of *Allium vineale* and *A. canadense* in Hamilton County, Ohio, by the use of fuel oil as a spray is briefly discussed.

Similar work conducted by the Indiana Experiment Station (E. S. R., 31, p. 739) with orchard heating oil is noted.

Eradication of bracken (*Univ. Col. N. Wales, Bangor, Dept. Agr. [Pub.] 5 (1914), pp. 7*).—This publication reports further experiments, conducted on six experimental farms, in the eradication of bracken in pasture lands. The indications are that by the end of the second year the bracken had been nearly exhausted by repeated cuttings, while the grass had been stimulated by the application of lime and manures.

Improvement of hill and peaty pastures; eradication of bracken (*Univ. Col. N. Wales, Bangor, Dept. Agr. [Pub.] 3 (1915), pp. 8*).—Experiments have been laid out at 15 centers for the treatment of poor pastures on peaty or hilly ground with basic slag, ground limestone, rock phosphate, and acid phosphate. The general results to date indicate that basic slag and rock phosphate improve pasture conditions, while lime used alone has had little or no effect.

Experiments with the eradication of bracken have been continued with much the same results as noted above.

HORTICULTURE.

On the problem of extra root nutrition and treatment of trees, V. LÎUBIMENKO (LUBIMENKO) (*Zap. Imp. Nikitsk. Sada [Îalta], No. 6 (1914), pp. 91–181, figs. 6*).—Experiments on the introduction of various solutions into the wood of growing trees are reported in detail. The solutions were introduced into the tree through a glass siphon attached to holes bored with an auger 5 mm. (0.2 in.) in diameter and bored to a depth of 1.5 to 2 cm. (0.6 to 0.8 in.).

The author found in part that the successful introduction of solutions into living trees is largely dependent upon exclusion of air from the holes and upon reduced root pressure accompanied by partial desiccation of the wood cells, i. e., reduced sap content. Other conditions being equal, the greater the amount of desiccation the greater the amount of solution absorbed and the wider its distribution throughout the tree. The solution filtering into the partially desiccated wood elements spreads in all directions, both lengthwise and crosswise of the fibers, filtration being more rapid lengthwise of the fibers. In cases where desiccation is severe enough to affect the roots infiltration of solutions may take place through the roots as well as through the trunk.

Of the species experimented with, the pear, apple, and peach are easily subject to desiccation of the wood during the summer period. The plum and the wild cherry tree are not so easily a prey to desiccation, while the ailanthus, Judas tree, cypress, lanuginous oak, Chinese privet, and the white mulberry are least subject to desiccation. Even with the first class of trees it is necessary to undertake these experiments during the hot and dry season when the desiccation of the wood is at its height.

As the quantity of liquid absorbed by the wood by means of infiltration into the elements emptied of sap depends on its degree of desiccation it is impossible to determine beforehand how many openings should be bored into the trunk and what the dimensions should be in order to obtain a uniform impregnation of the wood. The general rule given is that the smaller the

diameter of the tree and the drier its wood the smaller the number of the openings for uniform impregnation.

Although the author arrived at no conclusion as to the practical value of introducing solutions in tree trunks it is believed that the results obtained indicate that the method is worthy of further study, particularly with trees such as the pear and apple, that are subject to drying during the hot summer period.

Some observations upon the relation of humidity to the ripening and storage of fruits, A. D. SHAMEL (*Mo. Bul. Com. Hort. Cal., 6 (1917), No. 2, pp. 39–41*).—Some data are given on experiments conducted by the author in cooperation with F. F. Chase in a lemon storage and packing house at Corona, Cal., during the 3-year period, 1914–1916.

In an experimental curing of a roomful of lemons with the room maintained for four weeks at about 90° F. and about 90 per cent relative humidity more than 90 per cent of the cut stems of the fruits calloused over perfectly in the same manner that cuttings callous over under favorable conditions. Further experiments showed that the development of the calloused condition depended largely upon the maintenance of a uniform condition of relative humidity. Callous developed more rapidly at a high temperature, such as 95°, than at a low temperature, such as 60°. With the daily humidity fluctuating from 50 per cent to 95 per cent very little development of callous was observed.

With uniformly high relative humidity of about 90 per cent comparatively little loss of weight in the fruits was observed irrespective of the temperature during the storage. The lemons also developed a smoother texture, lighter color, and better commercial appearance than where a condition of low relative humidity, e. g., 70 per cent, was maintained, or where the relative humidity fluctuated considerably during the storage.

On August 4, 1916, a box of hard, ripe Bartlett pears was placed with the lemons in one of the curing rooms, where temperature and humidity records were taken for 30 days. At the same time a similar lot of pears was placed in a family storage room without regard to temperature or humidity. The pears in the family storage room turned yellow and ripened perfectly by August 10, whereas the pears in the lemon room remained hard and green until the end of the experiment on September 3. At the beginning of the experiment these pears were exposed to a temperature as low as 83°. For the most part after this date the temperature was very high, reaching 100° on August 27. The relative humidity was uniformly high, being 96 per cent on August 17 and ranging from 85 to 96 per cent between August 5 and August 21. The humidity was below 80 per cent only nine days out of the period. Sample pears removed from the lemon room from time to time ripened within six or seven days from the date of withdrawal.

In lieu of further observations no definite explanation is offered why the pears were held for 30 days at the high temperatures recorded without ripening or deteriorating. The investigators believe, however, that the condition of high relative humidity was a controlling factor in retarding ripening.

Statistics of fruits in principal countries, H. D. RUDDIMAN (*U. S. Dept. Agr. Bul. 483 (1917), pp. 40*).—A brief statistical survey of production, exports, and imports of fruits for the United States and other important producing, exporting, and consuming countries. The data given are based upon figures taken from official sources, usually from publications of the countries treated.

Minnesota State Fruit-Breeding Farm in 1916, C. HARALSON (*Minn. Hort., 45 (1917), No. 2, pp. 49–55, pl. 1, figs. 2*).—A brief progress report on breeding work with apples, strawberries, raspberries, grapes, plums, and cherries, with discussion following.

Report on investigations of the botanical laboratory of the Imperial Nikitsky Orchard in *1912* (*Zap. Imp. Nikitsk. Sada* [*I͡Alta*], *No. 6* (*1914*), *pp. 183–200, pls. 5*).—Experiments in crossbreeding with peaches, apples, pears, and grapes are reported.

Experiments in the production of parthenocarpic apples and pears by preventing pollination were for the most part negative, only one apple and four pears being secured. Experiments in ringing fruit branches resulted in a rapid dying off of the branches and consequent loss of fruit. A study of the influence of seeds of the apple on the development of the pericarp showed a close relation between seeds and pericap development. The greater the number of seed the greater was their influence on the pericap.

Apple growing (*Mass.* [*Bd.*] *Agr. Bul. 2, 5. ed., rev.* (*1916*), *pp. 258, pls. 25, figs. 31*).—Some of the articles in the previous edition of this bulletin (E. S. R., 30, p. 739) have been superseded by new ones and a number of other new articles relating to apple growing have been added. The subject matter as a whole has been revised where deemed necessary.

The apple in Canada, its cultivation and improvement, W. T. Macoun (*Canada Expt. Farms Bul. 86* (*1916*), *pp. 136, figs. 25*).—This bulletin records the results of experimental work with the apple at the Central Experimental Farm and branch farms and stations of Canada, and gives information relative to best methods of propagating apples, varieties recommended, and the planting and care of orchards. The experimental data recorded deal largely with investigations with seedling and cross-bred apples, yields of individual trees of the same varieties, the closely planted Wealthy apple orchard, and other work previously reported on from time to time (E. S. R., 33, p. 236).

Harvesting, packing, and marketing the apple crop, A. F. Mason (*Penn. State Col. Ext. Circ. 50* (*1916*), *pp. 44, figs. 34*).—A popular treatise on the subject, including illustrated descriptions of various types of grading and sizing machinery.

Sending apples by parcel post, P. Thayer (*Mo. Bul. Ohio Sta., 1* (*1916*), *No. 12. pp. 377–382, figs. 6*).—An account of the station's experience in marketing apples by parcel post during the past three years. The styles of packages used are illustrated and described and the results of shipping tests for each year are given.

The results in general show that apples when not too ripe and when well packed will carry to almost any distance with little or no injury. For short distances, as within the second postal zone, and for small quantities parcel post is much cheaper than express. For large quantities or greater distances express rates are cheaper. To insure profit packages must be put up in quantities in advance of orders.

The native pears of North Africa, L. Trabut (*Bul. Sta. Forest. Nord Afrique, 1* (*1916*), *No. 4, pp. 115–120, pls. 4, figs. 3*).—Observations on the geographic distribution of pears native to North Africa.

Problems and opportunities in the fig industry, J. E. Coit (*Cal. Citrogr., 2* (*1917*), *No. 5, pp. 6, 7, figs. 3*).—An outline of some of the problems in fig culture under investigation by the California Experiment Station.

Statistics on the production of grapes in 1916 (*Estadística de la Producción Vitícola en el Año 1916. Madrid: Govt., 1917, pp. 6*).—The usual statistical report on the production of grapes and wine in various regions and Provinces of Spain (E. S. R., 35, p. 744) during the year 1916, including comparative data for the five years commencing in 1912.

Tropical pomology.—A new field for horticulturists, W. Popenoe (*Univ. Cal. Jour. Agr., 3* (*1916*), *No. 6, pp. 221–228, figs. 2*).—Popular suggestions are

given relative to the possibilities of improving various tropical fruits and methods of growing them.

The navel orange of Bahia; with notes on some little-known Brazilian fruits, P. H. Dorsett, A. D. Shamel, and W. Popenoe (*U. S. Dept. Agr. Bul. 445 (1917), pp. 35, pls. 24, fig. 1*).—In addition to an account of the origin, history, and culture of the navel orange of Bahia, together with the introduction of the Washington navel orange of Bahia into the United States, notes are given on other citrus fruits and miscellaneous fruits grown at Bahia, citrus fruits and other fruits growing in the region around Rio de Janeiro, and fruits of the highlands and semiarid regions of Minas Geraes and Bahia. Comparative analyses of navel oranges grown at Riverside, Cal., and at Bahia, Brazil, made by H. C. Gore, are included.

The use of commercial fertilizers, J. F. Breazeale (*Cal. Citrogr., 2 (1917), No. 5, pp. 4, 5*).—A popular discussion of some of the fundamentals of fertilizer practice, with special reference to citrus groves.

The pomegranate, R. W. Hodgson (*California Sta. Bul. 276 (1917), pp. 163–192, figs. 15*).—An account of the pomegranate with reference to its range of culture in the United States, history, botany, horticultural varieties, climatic requirements, propagation, soils, orchard management, yields, returns, uses, diseases, insect pests, and other troubles.

Planting pecans, budding, grafting, and transplanting pecan trees, J. A. Evans (*Tex. Agr. Col. Ext. Serv. Bul. B–85 (1917), pp. 32, figs. 8*).—Practical instructions on budding, grafting, planting, and transplanting pecans are given, including information relative to varieties adapted to different sections of the State.

Profitable herb growing and collecting, Ada B. Teetgen (*London: Country Life, 1916, pp. XI+180, figs. 16*).—A compilation of information gleaned from publications issued by departments of agriculture in different countries concerning the culture, yield, profitable marketing, and kinds of medicinal plants and herbs.

Observations and experiments in poppy culture and the production of opium in the Province of Valladolid, Spain, C. Benaiges de Aris (*Bol. Agr. Téc. y Econ., 9 (1917), No. 97, pp. 55–63*).—Notes on poppy and opium production in general, including experimental results obtained on the Valladolid Farm.

The dahlia, L. K. Peacock (*Berlin, N. J.: Peacock Dahlia Farms [1917], 5. ed., pp. 80, pl. 1, figs. 62*).—A practical treatise on the habits, characteristics, cultivation, and history of the dahlia, including also descriptive lists of varieties.

Parks: Their design, equipment, and use, G. Burnap (*Philadelphia and London: J. B. Lippincott Co., 1916, pp. 328, pl. 1, figs. 167*).—A treatise on the principles of park design, comprising as a whole a guide for town and city officials intrusted with the development and maintenance of parks, a reference work for landscape architects and superintendents in designing parks, and a general work for the enlightenment of the public. The principles of design are here illustrated by photographs of parks in various cities and countries.

The successive chapters discuss park design in city planning, bringing up a park the way it should go, principles of park design, "passing-through" parks, neighborhood parks, recreation parks, playgrounds in parks, effigies and monuments in parks, architecture in parks, decorative use of water, planting design of parks, park administration in relation to planting design, seats in public parks, disposition of flowers in parks, and park utilities.

The food garden, W. F. Rowles (*London: Headley Bros. [1917], pp. 324, pls. 28, figs. 50*).—A manual on the culture and conservation of fruits and vegetables, with special reference to the home garden and greenhouse.

From garden to pantry, NELLIE R. DE LISSA (*London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd.* [*1916*], *pp. 110*).—A small practical treatise on the culture, harvesting, and home conservation of vegetables and fruits.

Vegetable growing, J. G. BOYLE (*Philadelphia and New York: Lea & Febiger, 1917, pp. IX+17–350, figs. 154*).—A text-book and treatise on the principles and practice of vegetable growing, with special reference to the home garden.

Report of the bureau of insecticides and fungicides for the year 1915, S. K. JOHNSON ET AL. (*Columbus, Ohio: State, 1916, pp. 37*).—This report contains tabulated analyses of insecticides and fungicides inspected under the Ohio insecticide and fungicide law in 1915, together with short articles relating to inspection work, the text of the Ohio insecticide and fungicide law, and a fruit-growers' spray calendar.

FORESTRY.

Forest terminology (*Jour. Forestry, 15* (*1917*), *No. 1, pp. 68–101*).—A list of terms in forestry compiled by a committee of the Society of American Foresters, together with a statement of principles guiding the committee in choosing terms. A number of the terms appearing in Bulletin 61 of the Forest Service of the U. S. Department of Agriculture (E. S. R., 17, p. 373) have been ruled out in the present list as either ill chosen or not necessary.

The situation, B. E. FERNOW (*Jour. Forestry, 15* (*1917*), *No. 1, pp. 3–14*).—A review of progress made in forestry in the United States as a policy, science, and art during the past 30 years.

Sixth biennial report of the state forester of the State of California, G. M. HOMANS (*Bien. Rpt. State Forester Cal., 6* (*1915–16*), *pp. 56, figs. 17*).—A report of activities during the biennial period 1915–16, including information relative to forest fire protection work by private, state, and federal agencies; city tree-planting work and legislation for its promotion; data on private eucalyptus plantations; and recommended legislation.

A short paper on Summer Homes on the National Forests, by C. DuBois, is also included.

Biennial report of the forestry commission for the years 1915–16, W. R. BROWN ET AL. (*Bien. Rpt. Forestry Com. N. H., 1915–16, pp. 177, pls. 19*).—A report for the biennial period 1915–16 giving a synopsis of the growth and present status of the state forestry work and reviewing recent progress along the following lines: The forest-fire service; reforestation; operations on the national, state, and municipal forests in New Hampshire; and educational and special projects. The state forest laws and data on the fire-service organization are appended.

Division of forestry and parks, F. B. MOODY (*Bien. Rpt. State Conserv. Com. Wis., 1915–16, pp. 69–138, figs. 23*).—A report of activities for the biennial period 1915–16 relative to forest protection, work on the state parks, forest-planting operations, and assistance rendered to private owners. The text is given of the forest-fire plan for protection of headwaters of the Wisconsin and Chippewa rivers, as developed by the Wisconsin Conservation Commission in cooperation with the Federal Government and others, together with papers by C. L. Harrington on State Forest Nurseries and on the Extent, Value, and Use of Wisconsin Woodlots. It contains the decision of the Supreme Court of Wisconsin restricting land purchases for extending the State Forest Reserve and reviews the forest fire protection work.

Continuous forest production of privately owned timber lands as a solution of the economic difficulties of the lumber industry, B. P. KIRKLAND (*Jour. Forestry, 15* (*1917*), *No. 1, pp. 15–64*).—In this paper the author reviews

existing conditions affecting the lumber industry, with special reference to destructive competition; presents data to justify forestry as a permanent business proposition; and emphasizes the importance of organized control, whether by public or private agencies. Suggestions are given relative to methods of controlling the lumber industry.

Farm woodlot timber: Its uses and principal markets, G. N. Lamb (*Purdue Univ. Dept. Agr. Ext. Bul. 51* (*1916*), *pp. 24, figs. 2*).—An account of the native commercial species, their uses, specifications, market prices, and important markets for woodlot products. The subject matter is based on a study of Indiana woodlots conducted by the Forest Service of the U. S. Department of Agriculture in cooperation with the Department of Agricultural Extension of Purdue University.

Trees planted by new machine replace railway snow fences, H. Smith (*Engin. News, 77* (*1917*), *No. 11, pp. 432, 433, figs. 4*).—Planting plans used in forming windbreaks in place of snow fences along the Minneapolis, St. Paul, and Sault Ste. Marie Railway are given. A tree-planting machine successfully used in this work is illustrated and described.

The Christmas tree industry, E. Secrest (*Mo. Bul. Ohio Sta., 1* (*1916*), *No. 12, pp. 371–374, fig. 1*).—Popular suggestions are given relative to the planting, care, and marketing of Christmas trees.

The greenheart of commerce, C. D. Mell (*Amer. Forestry, 22* (*1916*), *No. 269, pp. 288–291, figs. 6*).—A popular account of the greenheart tree (*Nectandra rodiœi*), of the Guianas and Venezuela, relative to its distinguishing characteristics, exploitation, mechanical properties, and commercial importance.

True mahogany, C. D. Mell (*U. S. Dept. Agr. Bul. 474* (*1917*), *pp. 24, pls. 3, figs. 4*).—An account of the true mahogany (*Swietenia* spp.) with reference to its common names, geographical distribution, general characteristics of the wood, characteristics of the wood from different regions, market value, uses and supply, importations to the United States, methods of logging and transportation, botanical characteristics, and minute characters of the wood. The author concludes with a list of cabinet woods from various countries which resemble true mahogany in one or more characters and are frequently marketed as mahogany.

Contribution to the knowledge of red quebracho, J. B. Galarza (*Trab. Inst. Bot. y Farmacol., Buenos Aires, No. 32* (*1915*), *pp. 69, pls. 2, figs. 31*).—An account of the red quebracho (*Schinopsis* spp.), with reference to its botany, histology, geographic distribution, exploitation of lumber and tannin extract, physical and chemical properties, commerce, and uses. Data on mechanical tests of the wood are given and the strength values compared with various other Argentine woods. Analytical data are also given showing the tannin content of numerous samples.

A bibliography of cited literature is appended.

Lumbering in the sugar and yellow pine region of California, S. Berry (*U. S. Dept. Agr. Bul. 440* (*1917*), *pp. 99, pls. 14, fig. 1*).—The introductory part of this bulletin gives a general account of the region, the forest, types of operations, labor, camps, and factors affecting the cut. Part 2 treats in detail of logging operations, including the preparing of logs for transport, the various stages of transportation, and woods supervision. Part 3 discusses the manufacture of lumber, and part 4 deals with general cost factors, consideration being given to overhead charges, depreciation, and the costs of typical operations.

An annotated list of the forest trees of the Hawaiian archipelago, V. MacCaughey (*Bul. Torrey Bot. Club, 44* (*1917*), *No. 3, pp. 145–157*).—A check list to the Hawaiian arborescent flora.

British-grown timber and timber trees, A. D. WEBSTER (*London: William Rider & Son, Ltd., 1916, pp. XII+164, pls. 41, fig. 1*).—A concise description of each species, together with notes as to their value for ornamental and economic planting, including an account of the soils suited to their cultivation, the uses to which the timber is applied, the current value of the wood, etc.

DISEASES OF PLANTS.

[Report of the research assistant in plant pathology], G. H. COONS (*Michigan Sta. Rpt. 1916, pp. 265–274*).—The author describes the various lines of work in progress during the year, particular attention having been paid to the cause and control of a certain limb and twig disease of the apple. The disease in question was found to be due to *Plenodomus fuscomaculans*, and preliminary accounts of some of the phases of the investigation have already been given (E. S. R., 34, p. 647; 35, p. 653) in connection with investigations carried on under the author's direction.

Considerable advance has been made in the study of bean diseases and their control, and while preventive treatment by hot water or chemicals has given little promise for the control of bean anthracnose and blight, it has been found possible by the planting of resistant varieties to escape serious losses. In connection with this investigation, the feasibility of growing beans for seed purposes in western regions where blight does not exist has been demonstrated.

Some notes are given on investigations of potato diseases, particularly a wilt due to Fusarium, the efficiency of some forms of sterilization of soil in connection with the growing of celery, and miscellaneous pests of potatoes, grain, and vegetables. Among the vegetable diseases reported upon is a fruit rot of tomato, from which a yellow bacterial organism has been isolated that seems to differ from *Bacterium michiganense*, especially in the fact that no wilting of the stem occurs.

[Plant diseases in Uganda, 1915], R. FYFFE (*Ann. Rpt. Bot., Forestry and Sci. Dept. Uganda, 1915, pp. 5, 6*).—It is stated that Para rubber trees suffered considerably during the year from attacks on the roots by *Fomes semitostus* and *Hymenochæte noxia*. The former is found to propagate itself only by means of mycelium. Both are controlled by trenches isolating affected areas, by sprinkling lime around affected trees, and by exposing the roots to the sun's rays.

A few pods of cacao (*Theobroma cacao*) affected with brown rot (*Phytophthora faberi*) were burnt, this being considered to be the best means for control of the disease.

Costa Rica coffee plants were found to be susceptible to *Hemileia vastatrix* as are any of the other varieties of coffee cultivated in this country. A variety of coffee grown from seed obtained from the Sese Islands appears to be the most resistant yet tried, except perhaps a single old tree of *Coffea liberica* said to be very robust but of slow growth.

Phytopathological work in the Tropics, J. R. JOHNSTON (*Phytopathology, 6 (1916), No. 5, pp. 381–386*).—Attention is called to the necessity of phytopathological studies in the Tropics, and some of the work in progress is briefly described. A plan is outlined for a greater amount of cooperation in investigations and a better coordination of efforts for the control of plant diseases in the American Tropics.

Facultative heterœcism of Peridermium harknessii and Cronartium quercus, F. D. FROMME (*Phytopathology, 6 (1916), No. 5, pp. 411, 412*).—The author criticizes the conclusion of Meinecke (E. S. R., 36, p. 454) regarding facultative heterœcism in these two rusts and states that the cases cited do not meet the

requirements which would establish this claim. The ability of these rusts to exist in the absence of an alternate host plant is indicated, but this alone does not constitute autœcism nor facultative heterœcism.

Studies of the genus Phytophthora, J. ROSENBAUM (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 7, pp. 233–276, pls. 7, figs. 13; Proc. Nat. Acad. Sci., 3 (1917), No. 3, pp. 159–163*).—Based on cultural and other studies of 11 of the 13 described species of Phytophthora, a tentative key is presented for the identification of the species.

Mechanism of tumor growth in crown gall, E. F. SMITH (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 5, pp. 165–188, pls. 62*).—A detailed account is given of experiments previously reported (E. S. R., 36, p. 46), with suggestions as to what is believed to be the proximate cause of the abnormal cell proliferation in crown gall. The experiments described are considered to have an important bearing not only on the production of crown gall and other tumors in plants but also on the origin of animal tumors.

The author believes that in the local osmotic action (possibly, in some stages, chemical action also) of various substances thrown into cells and diffusing from them in all directions, as the result of the metabolism of a feeble intracellular parasite or symbiont together with the resultant counter movements of water and food supply, there is, in crown gall at least and presumptively also in animal neoplasms, an explanation of tumor growth.

Intoxicating bread, N. A. NAUMOV (*Min. Zeml. [Russia], Trudy Bi̇̄uro Mikol. i Fitopatol., Uchen. Kom., No. 12 (1916), pp. 216, pls. 8, fig. 1*).—This publication represents a further progress report of work on the disease of grain called "drunk bread" (E. S. R., 35, p. 845).

The author has made extensive studies of this disease, especially the relation of the causal organisms to the hosts, their biology, and possible control measures. It is definitely stated that this trouble of cereals is due to the activities of two species of Fusarium, *F. roseum* and *F. subulatum*, which attack rye, wheat, oats, and barley, not infrequently in quite alarming proportions, as much as 88 per cent of infection having been observed on barley in 1912. Infected seed and infected soil are the chief sources of the disease, while humidity and high temperature are the main factors in the spread of the epidemic. Diseased seed is recognized by the presence of the fungus mycelium in the grains. Positive results were obtained in artificial inoculations of soil, seedlings, and heads with conidia and ascospores and also in artificial inoculations of soil and shoots with the mycelium.

If the infected grain is stored under ordinary conditions for a period of three years, the mycelium completely loses its vitality. Dry heat for 24 hours at 66° C. (150.8° F.) for rye and at 60° for wheat, oats, and barley, while without effect on the vitality of the seed, kills or at least greatly weakens the fungus mycelium imbedded in the grains. Other control measures recommended are seed selection, general sanitation, and proper crop rotation. Soaking of the affected seed in various fungicides was not found to be efficient, except when the spores or the mycelium of the parasites were present on the surface of the grains.

Glume rust of wheat, P. BERTHAULT (*Jour. Agr. Prat., n. ser., 29 (1916), No. 15, pp. 256, 257*).—An unusually severe outbreak of glume rust on wheat is noted as causing much loss to the crop of 1916. Several known cereal rust fungi, their modes of propagation, and protection therefrom are discussed.

Crown gall of alfalfa in France, G. ARNAUD (*Jour. Agr. Prat., n. ser., 29 (1916), No. 17, pp. 291, 292, fig. 1*).—A description is given of alfalfa crown gall and the mode of development and propagation of the causal fungus (*Urophlyctis alfalfæ*), with a short account of the appearance of this disease

in various countries since it was first noted by Lagerheim near Latacunga, Ecuador. There is added a discussion of related species and of diseases, more or less similar, of other plants.

Diseases of asparagus and of melon, G. Arnaud (*Ann. Serv. Epiphyties, Mem. et Rap., 2 (1913), pp. 273–284, figs. 9*).—The author reports a study on the fungus causing a disease of young asparagus plants, described as *Melanospora asparagi* n. sp., also on a disease of melon. The conidial form of the latter, previously described under several other names, is supposed to belong to the genus Fusarium, the perfect stage of which may be a Melanospora found in connection therewith.

Fungus and bacterial diseases of clover, A. A. Îachevskiĭ (Jaczewski) (*Min. Zeml. [Russia], Bi͡uro Mikol. i Fitopatol., Uchen. Kom. [Pub.], 1916, pp. 64, figs. 25*).—The author gives a list and descriptions of about 30 distinct diseases affecting the clover plant in Russia.

The majority of these are more or less known in the United States but special attention is called to two parasitic diseases, namely, a crown rot due to *Fusarium trifolii* n. sp., and a blossom mold caused by *Œdocephalum* (*Botrytis*) *anthophilum* n. sp. The mycelium of the latter parasite penetrates the seeds, thus carrying the disease from year to year and making its control difficult.

The blossom mold canker (*Sclerotinia trifoliorum*) and anthracnose (*Glœosporium caulivorum*) are considered the most serious troubles of clover and are widely distributed throughout the country. Rusts and leaf spots, although quite prevalent, do not cause material damage. Control measures, general as well as specific to individual diseases, are briefly mentioned. A list of 28 saprophytes, frequently associated with the diseased tissues, is appended, in order to assist observers in recognizing the primary cause of the trouble.

A new disease of the flowers of red clover and its relation to seed production, A. S. Bondartsev (Bondarzew) (*Zap. Sta. Isp. Sîem. Imp. Bot. Sad. (Ann. Samenprüf. Anst. K. Bot. Gart. Peter Grossen), 2 (1914), No. 3, pp. 23, pls. 3, figs. 6*).—The author reports on a fungus attack on the flowers of the red clover. The cause of the trouble is said to be *Botrytis anthophila* n. sp. The mycelium permeates the entire plant, growing intercellularly, and it produces its conidia in the anthers of the flowers, causing abnormal pollen grains of low germinative power. The mycelium has also been found within the seed coats, indicating that the disease may be seed-borne. Infected plants produce less seed than normal ones, and its specific weight is somewhat lower, but the germination of diseased seed was higher than that of sound seed. The forage production of the plants was not found to be influenced by the fungus.

A technical description of the fungus is given.

Relation of soil temperature to infection of flax by Fusarium lini, W. H. Tisdale (*Phytopathology, 6 (1916), No. 5, pp. 412, 413*).—In connection with an experimental study of flax wilt, the author has determined that the critical temperature for infection of flax by *F. lini* is about 15 to 16° C. (59 to 60.8° F.).

[Report of the assistant in plant pathology], J. H. Muncie (*Michigan Sta. Rpt. 1916, pp. 276, 277*).—A brief account is given of work carried on by the author on control measures for anthracnose and blight of beans. Attention is also called to a stem disease of beans that has caused serious damage to the crop. The stem is attacked at the first node, the plant is girdled, and it usually breaks over when the beans are about half mature. This disease is receiving further study.

Celery leaf spot (*Gard. Chron., 3. ser., 60 (1916), No. 1556, p. 196*).—In a summary of results of recent experimentation regarding the prevention and control of leaf spot of celery, which is said to have been particularly prevalent

in England this year, it is stated that, while hydrogen peroxid proves efficacious in this connection, it is unstable, deteriorating if kept. Corrosive sublimate of 0.1 per cent strength, used to soak the seed for half an hour (after softening for an equal period in warm water), is very successful. If infection appears on careful daily scrutiny during the growth of the plant, Bordeaux mixture should be used, after removal of the leaves most affected. As spores of the fungus (*Septoria petroselini apii*) do not survive for more than two or three years, seed of such age is fairly safe, if germinable.

A collar disease of pea, F. Guéguen (*Ann. Serv. Epiphyties, Mem. et Rap., 2 (1913), pp. 302–309, figs. 15*).—The author reports a study of a pea disease in the neighborhood of Paris, ascribed to a Fusarium said to have been considered by van Hall (E. S. R., 15, p. 375) as the conidial form of *Neocosmospora vasinfecta pisi*. He discusses the character of the lesions, the microscopic aspects of the fungus, its culture, and its capacity for infection.

The reappearance of Phytophthora infestans during the growth of the potato plant, J. Eriksson (*Compt. Rend. Acad. Sci. [Paris], 163 (1916), No. 4, pp. 97–100*).—Giving the results of recent studies, the author states that the blight fungus, *P. infestans*, does not appear for three or four months after planting, or until about the time when the blooms appear. In Sweden, the time of the primary outbreak in open fields may vary from the middle of July to the first of September, according to meteorological conditions. Moist weather favors the disease, which very quickly becomes general. The spots appear to be independent of each other. Under glass, if the tubers are planted in January the blight may appear by the middle of April, when the plants are as fully developed as those in the open fields late in summer, causing some check to growth and some deformation of the plants.

The changes occurring within the first day in the development of the parasitic organism, from the supposedly symbiotic or mycoplasmic stage, are described in some detail.

A Melanconium parasitic on the tomato, W. H. Tisdale (*Phytopathology, 6 (1916), No. 5, pp. 390–394, figs. 3*).—A more detailed account is given of a disease of tomatoes which has been previously noted (E. S. R., 36, p. 49).

In connection with this study, a Melanconium morphologically identical with the tomato parasite was found growing saprophytically on onions in the same greenhouse. The specific identity of the fungus has not been determined, but should the disease become of economic importance, it is expected that further study of the organism would be made.

The results of the experiments show that the fungus grows readily on tomato fruits when introduced through wounds, and that it is also able to attack uninjured fruits if the moisture conditions are suitable for germination and growth. There is said to be some indication that the disease is spread in the greenhouse by white flies.

A parasitic saccharomycete of the tomato, A. Schneider (*Phytopathology, 6 (1916), No. 5, pp. 395–399, figs. 4*).—The author reports having isolated, from tomatoes obtained in a restaurant in Berkeley, Cal., an organism which proved to be a saccharomycetous ascomycete. The affected tomato presented a slightly depressed area of about 2 cm. in diameter and of a peculiar dull, reddish-brown color. The epidermal tissue was somewhat shriveled, but the hypodermal tissue as well as the parenchymatous tissue underneath appeared nearly normal.

The fungus is a true parasite, as it develops in and on living tissues but will not develop in the presence of decay. Upon the death of the tomato tissues, the organism at once enters upon a very active spore formation.

A note on Phytophthora infestans occurring on tomatoes, S. P. Wiltshire (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1915, pp. 92, 93*).—A

fungus attacking severely tomato stems and finally the whole plant showed no external differences from *P. infestans* on potato, but it gave only a slight degree of infection on potato plants, *P. infestans* from potato produced no infection on tomato, the form appropriate to which is thought to be a physiological differentiated strain of *P. infestans*.

Spraying and dusting tomatoes, F. D. FROMME and H. E. THOMAS (*Virginia Sta. Bul. 213 (1916), pp. 3–14, figs. 3*).—Continuing previous work (E. S. R., 25, p. 548), the results are given of a comparative study of the efficiency of different spray materials and especially of some fungicides applied in the dust form for the control of the leaf spot (*Septoria lycopersici*) and the late blight (*Phytophthora infestans*) of tomatoes. The fungicides used were 4:5:50 Bordeaux mixture, superfine sulphur to which arsenate of lead was added, and two proprietary fungicides.

The results obtained show that none of the fungicides gave satisfactory control of the Septoria leaf spot, only about 15 per cent increase in uninfected leaves being noticed for the sprayed plants over the checks infected with the fungus. For the late blight and fruit rot, both the liquid and dust applications proved effective for controlling the diseases. Sulphur applied in dry form was the least effective of all the materials used. No foliage or fruit injury was produced by any of the applications.

Dusting and spraying nursery stock, V. B. STEWART (*New York Cornell Sta. Bul. 385 (1917), pp. 335–361, figs. 9*).—Preliminary investigations having given very successful results for the control of various leaf diseases of nursery stock by dusting (E. S. R., 34, p. 747), the author conducted further trials in 1916 on a more extensive scale, in which a dust mixture composed of 90 parts of finely ground sulphur and 10 parts of powdered arsenate of lead was employed in an attempt to control the leaf blotch of horse chestnut, leaf spots of currant, plum, cherry, and quince, apple scab, and mildew of rose.

The results obtained show that, if properly applied, dust sprays will control these diseases in the nursery. The dusting method is considered slightly more expensive, but the applications of the dust mixture can be made in a much shorter time and more thoroughly than can spraying mixtures applied with the usual machines employed by nurserymen.

A black rot of apples, G. T. SPINKS (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1915, pp. 94–96*).—In cases of rot showing different colors apparently corresponding purely to differences in variety of the apples affected with *Monilia fructigena*, it is suggested that the color relation depends upon the tannin content or upon the mechanical texture of the apple, but further investigations on this point are in progress.

A spot disease of apples, B. T. P. BARKER (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1914, pp. 97–99*).—A brief description is given of a spot disease noted in the winters of 1913 and 1914 as prevalent on certain varieties of apples grown at the institute. It is said to resemble in some ways Jonathan spot and bitter pit of apples in the United States. Microscopic examination shows fungus hyphæ which kill neighboring cells but do not penetrate deeply. The identity of the causal organism has not been determined. There appears to be some penetration of the cuticle by the fungus hyphæ, especially at weak spots. Internal conditions do not appear favorable to the continued development of the fungus.

Fungus and other diseases of stone fruits, G. P. DARNELL-SMITH and E. MACKINNON (*Agr. Gaz. N. S. Wales, 26 (1915), Nos. 7, pp. 589–598, pls. 8; 9, pp. 749–753, figs. 4*).—Notes are given on peach leaf curl (*Exoascus deformans*), brown rot (*Monilia fructigena*, the conidial stage, *Sclerotinia fructigena*, the ascigerous stage, being unknown in Australia), rush (*Puccinia

prunispinosæ), and peach freckle, black spot, or scab (*Cladosporium carpophilum*), as regards their relations, behavior, and control.

Plum diseases, E. Rabaté (*Ann. Serv. Epiphyties, Mem. et Rap., 2 (1913), pp. 341–346*).—This is a brief account of observations regarding brown rot (*Monilia cinerea*) of plum, which was followed by plum pockets (*Exoascus pruni*), resulting in serious loss in the neighborhood of Agen.

Comparative tests with fungicides against grape downy mildew, G. Caruso (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 12 (1915), No. 2, pp. 150–155*).—Tests carried out during the months of May to July, 1914, as described in connection with rainfall, are said to show that about the same protection against grape downy mildew is given by nine sprayings with a 1 to 1.5 per cent preparation of a copper product, recommended by the electrical and electrochemical society of Caffaro, as by the same number of sprayings with a 0.5 to 1 per cent Bordeaux mixture.

Second series of comparative tests with fungicides against grape downy mildew, G. Caruso (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 13 (1916), No. 2, pp. 47–55*).—The work above noted was continued in 1915, the frequency and abundance of precipitation necessitating 10 treatments extending from May 12 to August 11. A degree of superiority of Bordeaux mixture at 0.5 to 1 per cent over the competing compound at concentrations lower than 1 to 1.5 per cent was again demonstrated.

A bacterial disease of the gooseberry, B. T. P. Barker and O. Grove (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1915, pp. 97–99*).—Specimens of gooseberry bushes diseased in a peculiar manner were found to contain an organism apparently identical with that described in connection with a disease of pear (E. S. R., 33, p. 148). The outbreaks may be conditioned by such factors as the influence of weather on susceptibility.

A new remedy for American gooseberry mildew, I. E. Barbarin (*Reprint from Zap. Simferopol. Otd. Imp. Ross. Obshch. Sadov., No. 157 (1915), pp. 10*).—The author has continued his studies (E. S. R., 34, p. 842) of arsenical compounds as fungicides. The results of field spraying experiments with sodium arsenate in 1915 fully corroborated the positive evidence previously secured in laboratory studies. Four applications of this compound, one before, three after the blossoming period, with intervals of from 10 to 20 days, held in check the gooseberry mildew (*Sphærotheca mors-uvæ*).

The author recommends making the spraying solution not stronger than 1 gm. of sodium arsenate to 3 liters of water, and solutions of 0.5 to 0.75 gm. in the same amount of water are considered preferable. There seems to be very little danger of burning the leaves of the gooseberry plant. As this danger is quite serious in case of some other plants, the use of sodium arsenate for these is not recommended until definite methods are discovered to prevent burning of the leaves.

Studies on diseases of mulberry in 1913, G. Arnaud and C. Secrétain (*Ann. Serv. Epiphyties, Mem. et Rap., 2 (1913), pp. 233–265, figs. 19*).—This is a report of studies regarding mulberry gummosis (*Bacterium mori*), leaf rust (*Cylindrosporium mori*), dieback (*Nectria cinnabarina*), sclerotium disease (*Sclerotinia libertiana*), a root disease showing symptoms analogous with those of the root rot due to *Armillaria mellea* (which is also described as destructive), and a dropsy or gummosis of the trunk sometimes showing concretions of oxalate of lime crystals, along with other factors influencing diseases of mulberry.

"Canker" and "dieback" disease of mulberry, E. S. Salmon and H. Wormald (*Gard. Chron., 3. ser., 60 (1916), No. 1548, pp. 95, 96, figs. 3*).—A description is given of a dieback of mulberry twigs due to their being partly or

wholly ringed by a fungus which is said to be *Fusarium lateritium*. This has been hitherto regarded as a harmless saprophyte.

Eelworm in daffodils, A. J. Bliss (*Gard. Chron., 3. ser., 60 (1916), No. 1547, pp. 83, 84*).—The author cites experiences which are thought to justify the belief that the disease of narcissus bulbs attributed by Massee to *Fusarium bulbigenum* (E. S. R., 30, p. 354) is really due, at least in large part, to the nematode *Tylenchus devastatrix*. He advises the use of a light, sandy soil known to be free from nematodes, good cultivation and drainage, avoidance of farmyard manures, careful examination of bulbs before setting, careful handling, shallow planting, and removal of all suspected bulbs.

Leaf spot rot of pond lilies caused by Helicosporium nymphæarum, F. V. Rand (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 6, pp. 219–232, pls. 4*).—An account is given of an irregular spotting and decaying of leaves of pond lilies, which was first noticed in the spring of 1913. The causal organism has been isolated and its pathogenicity demonstrated by successful inoculation into 9 species of Nymphæa. The fungus is described as a new species under the name *H. nymphæarum*.

Spraying experiments with ordinary Bordeaux mixture and soda Bordeaux mixture have been conducted with successful results on a commercial scale.

Studies on chestnut tree diseases, V. Ducomet (*Ann. Serv. Epiphyties, Mem. et Rap., 2 (1913), pp. 101–108, figs. 3*).—Discussing the geographical distribution and extension of the disease called back canker, its causation, and protective measures, the author expresses doubt as to its being caused exclusively by *Melanconis modonia* (*M. perniciosa*) and its Coryneum form, as a disease apparently comparable is associated with *Cylodiplospora castaneæ*.

Treatment of the soil by disinfecting it with carbon bisulphid and by the addition of chemical fertilizers failed to check the progress of the disease, but cutting away the diseased upper portion of a tree infected with Coryneum apparently stopped its progress. It is thought that Melanconis is not primarily the causative parasite. Of the Japanese varieties showing resistance to black canker, two proved to be susceptible, though in different degrees, to oak tree Oïdium.

Black canker of chestnut and the restoration of the chestnut, A. Prunet (*Ann. Serv. Epiphyties, Mem. et Rap., 2 (1913), pp. 67–100, figs. 5; abs. in Alpe [Italy], 2. ser., 3 (1916), No. 6, pp. 168–177, fig. 1*).—The author gives an account of the parasitic character and the effects of black canker, ink disease, or black root of chestnut. This has been known in northern Italy since 1842 and since noted throughout a large part of Mediterranean Europe and as far west as the Azores, but probably not in Asia Minor or Africa. The author discusses the attempts made to restock areas where the chestnuts have been destroyed, by use of the common chestnut and of Asiatic (particularly Japanese) species which appear more or less resistant to this disease; also by the use for stocks of other trees resistant to black canker.

A method to induce sporulation in cultures of Botryosphæria berengeriana, J. Matz (*Phytopathology, 6 (1916), No. 5, pp. 387–389, fig. 1*).—The author states that *B. berengeriana* seldom forms spores in ordinary cultures. It was discovered that by sterilizing and inoculating pieces of pecan twigs and covering these with paraffin after inoculation pycnidia containing pycnospores were readily produced.

Phacidium infestans on western conifers, J. R. Weir (*Phytopathology, 6 (1916), No. 5, pp. 413, 414*).—The author reports the occurrence of *P. infestans* on *Abies grandis*, *A. lasiocarpa*, *A. concolor*, and *Pseudotsuga taxifolia*, and states that in the Western Hemisphere it seems to occur chiefly between the fortieth and forty-fifth degrees of latitude. In Sweden it is stated that the

fungus rarely occurs below the sixtieth degree of latitude. So far the fungus has not been discovered in forest nurseries, but from the fact that natural reproductions succumb very readily to attack it is considered a possible menace in all nurseries where firs are grown.

Pinus ponderosa and P. jeffreyi, hosts for Razoumofskya americana, J. R. WEIR (*Phytopathology, 6 (1916), No. 5, p. 414*).—In addition to *P. contorta* and *P. banksiana*, the author reports the above species as host plants for this dwarf mistletoe.

A preliminary report on the occurrence of western red rot in Pinus ponderosa, W. H. LONG (*U. S. Dept. Agr. Bul. 490 (1917), pp. 8*).—A more extended account of investigations already noted (E. S. R., 35, p. 655).

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Nematode parasites of mammals of the orders Rodentia, Lagomorpha, and Hyracoidea, M. C. HALL (*Proc. U. S. Nat. Mus., 50 (1916), pp. 1–258, pl. 1, figs. 290*).—This systematic work includes descriptions of 2 superfamilies, 5 subfamilies, 1 tribe, 8 genera, and 11 species new to science. A list of hosts and their parasites, a bibliography of 16 pages, and a complete index are included.

Diagnosis of plague in rats, C. L. WILLIAMS (*Pub. Health Rpts. [U. S.], 31 (1916), No. 33, pp. 2199–2205*).—"In the presence of an epizootic of plague, macroscopic examination alone for the detection of rodent plague results in appreciable error; the microscopic examination of smears should therefore be employed as a supplement to the naked-eye diagnosis of rodent plague when the epizootic declines. This error is greater toward the end of an epizootic and is of particular importance when eradicative measures are being employed. By routine examination of smears a materially important number of infected rats may be discovered that would otherwise pass undetected."

Propagation of wild duck foods, W. L. MCATEE (*U. S. Dept. Agr. Bul. 465 (1917), pp. 40, figs. 35*).—This bulletin supersedes Biological Survey Circular 81 and Department Bulletin 58, previously noted (E. S. R., 25, p. 757; 30, p. 545).

Report of the entomological department, J. TROOP (*Indiana Sta. Rpt. 1916, pp. 41, 42*).—In observations made in breeding cages and in the orchard with the codling moth it was found that the moths did not appear at any definite time but extended over a period of more than two weeks. In examinations made of orchards of progressive fruit growers it was found that they had practically no trouble with the codling moth, thus indicating that the trouble which certain growers experienced was local and probably due to faulty spraying.

An outbreak of flea beetles on corn took place in Orange County and the southern part of Lawrence County, the corn being attacked when from 2 to 4 in. in height.

In experiments with washing powders as insecticides it is stated that Pearline and Snow Boy both spread well, kill all aphids hit, and do not injure the plants. It is recommended that Pearline be used at the rate of two tablespoonfuls to a pint of water and Snow Boy at the rate of one tablespoonful to a pint of water.

Report of the south coast laboratory, E. G. SMYTH (*Rpt. Bd. Comrs. Agr. P. R., 4 (1915), pp. 45–50*).—This report relates particularly to biological studies at Santa Rita of eight species of scarabeid beetles known to injure sugar cane or to be found in sugar-cane fields in Porto Rico, namely, *Lachnosterna* "grande," *L.* "media," *L.* "pequeña," *Ligyrus tumulosus, Strategus titanus, S. quadrifoveatus, Dyscinetus trachypygus*, and *D. barbatus*. The com-

plete life histories of the eight species have been worked out from egg to adult, and a tabular summary is given of the average time in days and the maximum and minimum periods for each stage of the beetles.

It was found during the year that two distinct varieties of *Lachnosterna* "grande" and of *L.* "media" occur on the island. It is said to be necessary to fumigate the holds of the boats bringing cane from the Dominican Republic, due to the fact that in that Republic the leaves of the cane are eaten by the caterpillar of a butterfly (*Calisto archebates*), which is a source of severe injury to the plant.

[Contributions from the phytopathological service at Wageningen] (*Meded. Phytopath. Dienst Wageningen, 1916, Nos. 1, pp. 14, pls. 3; 2, pp. 14, pls. 3; 3, pp. 22, pls. 3*).—These papers relate, respectively, to the twig borer or budworm (*Incurvaria capitella*) of currants, the "red worm" (*Lampronia rubiella*) of raspberries, and the small winter moth (*Cheimatobia brumata*). Maps showing the distribution of these insects in the Netherlands are included.

[Italian entomological communications] (*Ann. R. Scuola Sup. Agr. Portici, 2. ser., 12 (1914), pp. 223–258, 391–418, 475–616, 655–682, 711–720, pls. 3, figs. 117*).—The papers here presented that relate to economic entomology are: Description of a New African Coccinellid (*Serangium giffardi* n. sp.) (pp. 223–236), previously noted (E. S. R., 32, p. 453), and Investigations of an African Phorid (*Aphiochæta xantina*), with Particular Consideration of the External Anatomy of the Larva (pp. 237–258), by G. Grandi; Agriculture and Malaria in the Valley of the Enza, by G. Rossi (pp. 391–418); Contribution to the Knowledge of the Termites of West Africa, by F. Silvestri (pp. 475–616); A Disease of the Larva of *Porthesia chrysorrhœa* in the Province of Campobasso, by B. Majmone (pp. 655–661); Notes on Two Microphagous Coccinellids, *Thea 22-punctata* and *Vibidia 12-guttata* (pp. 663–672), Will the Mediterranean Fruit Fly (*Ceratitis capitata*) Develop in Italian Lemons? (pp. 673–676), previously noted (E. S. R., 35, p. 259), and Some Experiments with *Eccoptogaster* (*Scolytus*) *amygdali*, *E. rugulosus*, and *E. pruni*, Serious Enemies, Respectively, of the Almond, Peach, and Plum (pp. 677–682), by G. Martelli; The Control of *Chrysomphalus dictyospermi pinnulifera* and *Icerya purchasi* in the Province of Messina, by A. Drago (pp. 711–717); and Studies and Observations on the Control of Sooty Mold of Citrus and the Olive by Means of Lime-sulphur in the Province of Messina during 1911, by F. Portale (pp. 719, 720).

Pests of orange trees and other Aurantiaceæ, G. Bondar (*Insectos Damninhos a' Agricultura.—III, Pragas das Laranjeiras e Outras Auranciaceas. São Paulo: Duprat & Co., 1915, pt. 3, pp. 47, figs. 28; rev. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 6, p. 201*).—This third paper (E. S. R., 30, p. 657) is a summary of information relating to citrus insects in Brazil.

On some animal pests of the Hevea rubber tree, E. E. Green (*Trans. 3. Internat. Cong. Trop. Agr. 1914, vol. 1, pp. 608–636*).—A summary of the more important mammal and insect enemies of rubber.

Entomophagous insects and their practical employment in agriculture, A. Berlese (*Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 3, pp. 321–332*).—A brief review of the subject.

The causes which affect the toxicity of arsenicals employed in agriculture, J. Battail (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 37 (1916), No. 19, pp. 448–452; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 7, pp. 307, 308*).—While the insecticidal value of the arsenical salts in general use in agriculture is proportional to the amount of arsenic they contain, their order of toxicity is modified by the varying degree of solubility and the presence of a toxic metal or of impurities. Their arrangement in order of toxicity and the percentage of

arsenic is as follows: Arsenate of lime 37.9, lead arsenate 16.7, sodium arsenate 36, arsenite of copper 34.5, iron arsenate 33.6, and copper arsenate 32 per cent.

Termes gestroi as a pest of the Para rubber tree, H. C. PRATT (*Trans. 3. Internat. Cong. Trop. Agr. 1914, vol. 1, pp. 637–640*).—A brief account of the injury caused by this termite.

[Use of d'Herelle's bacillus (Coccobacillus acridiorum) in the control of Schistocerca peregrina] (*Ann. Inst. Pasteur, 30 (1916), Nos. 5, pp. 209–242, figs. 11; 7, pp. 319–329, figs. 4; 8, pp. 388–421, figs. 7; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), Nos. 8, p. 351; 10, pp. 410, 411; 11, p. 481*).—The several papers reporting upon the biological method of controlling *S. peregrina* are by Étienne Sergent (p. 209–224) on a trial campaign in the valley of the Upper Tafna, mixed commune of Sebdu (Department of Oran), Algeria—the existence of a natural infection which produced immunity (May, June, and July, 1915); by M. Béguet (pp. 225–242) on a trial campaign in Algeria from December, 1914, to July, 1915, and more particularly in the Barik region (Department of Constantine); by Musso (pp. 319–329) on a trial campaign in the region of Bougzoul-Msiline, mixed commune of Boghar, Algeria, in May and June, 1915; and by H. Velu and A. Bouin (pp. 388–421) on an attempt to destroy *S. peregrina* in Morocco.

The Tingitoidea of Ohio, H. OSBORN and C. J. DRAKE (*Ohio State Univ. Bul., 20 (1916), No. 35, pp. 217–251, figs. 28*).—This synopsis of the "lace-bugs" of Ohio includes descriptions of 2 genera and 11 species new to science. Twenty-two species representing 12 genera are recorded, several of which have not as yet been collected within the State.

Review of the Philippine Membracidæ, W. D. FUNKHOUSER (*Philippine Jour. Sci., Sect. D, 10 (1915), No. 6, pp. 365–405, pls. 2, figs. 3*).—This synopsis of the membracids recognized from the Philippines includes descriptions of new genera and species and a bibliography of the literature.

The green bug or spring grain aphis (Toxoptera graminum), S. W. BILSING (*Texas Sta. Circ. 13 (1916), pp. 5–8, figs. 2*).—This circular contains information concerning the green bug and its control that is based on observations made during a trip of inspection through the wheat-growing sections of the State during the latter part of January and the first part of February.

Elm leaf rosette and woolly aphid of the apple, Schizoneura lanigera (americana in part), EDITH M. PATCH (*Maine Sta. Bul. 256 (1916), pp. 329–344, pls. 5*).—This revised edition of Bulletin 217, previously noted (E. S. R., 30, p. 548), contains such changes as bring the subject up to date.

A contribution to our knowledge of the white flies of the subfamily Aleyrodinæ (Aleyrodidæ), A. L. QUAINTANCE and A. C. BAKER (*Proc. U. S. Nat. Mus., 51 (1917), pp. 335–445, pls. 46, figs. 10*).—The present paper, a continuation of the the authors' work on the classification of the Aleyrodidæ (E. S. R., 31, p. 755), includes descriptions of 10 subgenera and 36 species new to science.

The coccid enemies of the vine, J. FEYTAUD (*Bul. Soc. Etude et Vulg. Zool. Agr., 15 (1916), Nos. 1–2, pp. 1–11, figs. 4; 3–4, pp. 21–27, figs. 2; 5, pp. 43–46, figs. 2; 6, pp. 52–54, fig. 1; 7, pp. 65–74; 8, pp. 88–90*).—Of the many coccids noted, *Pulvinaria vitis*, *Lecanium persicæ*, *Targionia vitis*, and *Dactylopius vitis* are the most important in France.

The San José scale, H. R. PAINTER (*Oklahoma Sta. Circ. 41 (1916), pp. 3–7, figs. 3*).—A brief popular account.

The agricultural importance of the mycosis of Chrysomphalus dictyospermi, L. SAVASTANO (*R. Staz. Sper. Agrum. e Frutticol. Acireale, Bol. 21 (1916), pp. 8; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 6, p. 222*).—Reports

by citrus growers of the disappearance of *C. dictyospermi* in Calabra led to investigations which showed this to be principally due to the scale being attacked by a fungus of the genus Cladosporium.

Problems connected with the new Egyptian cotton pest, Gelechia gossypiella, the pink bollworm, L. H. Gough (*Trans. 3. Internat. Cong. Trop. Agr. 1914, vol. 1, pp. 385–398*).—Substantially noted from another source (E. S. R., 35, p. 854).

Note on a machine to kill Gelechia larvæ by hot air, and the effects of heat on Gelechia larvæ and cotton seed, L. Gough (*Min. Agr. Egypt, Tech. and Sci. Serv. Bul. 6 (1916), pp. 15, pls. 3; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 11, pp. 472, 473*).—This is a description of a hot-air machine consisting mainly of a furnace for the generation of the hot air, a hot-air chamber through which the seed passes, and a motor. The results of work with the pink bollworm, reported in tables, show that there is ample limit for regulation of the temperature in such a way as to kill the worms without damaging the seed.

Life history of the codling moth in the Pecos Valley, New Mexico, A. L. Quaintance and E. W. Geyer (*U. S. Dept. Agr. Bul. 429 (1917), pp. 90, figs. 17*).—This is a report on life history studies of the codling moth conducted by the division of Deciduous Fruit Insect Investigations of the Bureau of Entomology in continuation of those previously noted (E. S. R., 33, p. 559). In the work at Roswell, N. Mex., in the Pecos Valley, special attention was given to the biology of the pest during 1912 and 1913 and to extensive spraying operations, but during 1914–15 the work was limited to orchard experiments.

The codling moth produced three generations in this valley during 1912, while in 1913 a partial fourth brood of larvæ developed. In 1912 pupation of the overwintering larvæ began March 15 and continued for about one month, while in 1913 the first pupa was observed March 23 and pupation continued for 51 days. During 1912 the moths of the spring brood appeared April 12 and continued to emerge to May 28. In 1912 oviposition of the spring brood of moths began April 16, continuing 45 days, while in 1913 the first eggs of this brood were noted May 1.

"The time required for first-brood eggs to hatch in 1912 was 9.05 days, with a range of 5 to 13 days, whereas in 1913 eggs of this brood hatched on an average in 5.96 days, with a range of from 4 to 11 days. First-brood larvæ in 1912 fed on an average 21.52 days, and in 1913, 24.45 days. The pupal stage of the first brood in 1912 averaged 12 days, and in 1913, 11 days. Moths of the first brood in 1912 were out June 9 and continued to emerge until July 22. In 1913 first moths were out June 3, the period of emergence lasting until July 10. First-brood moths in 1912 oviposited over an average period of 4.45 days, and in 1913 5.7. The life cycle of the first generation in 1912 required on the average 51.14 days, and in 1913, 46.91 days.

"Second-brood eggs in 1912 averaged 5.62 days for incubation, with a minimum of 4 and a maximum of 8 days. The incubation period of eggs of this brood in 1913 was on the average 4.9, with a minimum of 4 and a maximum of 7 days. The feeding period of second-brood larvæ in 1912 averaged 21.23 days, and in 1913, 19.7 days. The pupal stage for second-brood pupæ in 1912 averaged 11.23 days and in 1913, 11.06 days. The life cycle for the second generation of the codling moth in 1912 averaged 41.26 days, and in 1913, 41.04 days.

"Eggs of the third brood in 1912 averaged 5.75 days for the incubation period, with a minimum of 4 and a maximum of 9 days. In 1913 the incubation period for eggs of this brood averaged 5.36 days. During 1912 third-brood larvæ fed on an average of 26.55 days with a range of from 15 to 56 days, whereas in 1913 the average feeding period for this brood was 20 days, the range

being from 15 to 28 days. The pupal stage of the third brood in 1912 required on an average 14.94 days, with a minimum of 11 and a maximum of 20 days. The average length of this stage in 1913 was 11.4 days, with a minimum of 7 and a maximum of 17 days. The life cycle of the third generation of 1912 required on an average 48.57 days with a range of from 36 to 62 days, and in 1913, 43 days with a range of 34 to 58 days.

"Fourth brood eggs were in evidence in 1913 on August 20, and oviposition continued to September 8. The incubation period, on an average, was 7.9 days. The feeding period of fourth-brood larvæ in 1913 averaged 38.36 days, with a minimum of 25 days and a maximum of 53 days. All of these larvæ passed the winter as such. . . .

"Successful band records were made during 1913 at Roswell, Artesia, Lincoln, and Santa Fe. From available data the conclusion is drawn that at Lincoln there occur two full generations and a partial third, while at Santa Fe, a more northerly location, there appears to be but one complete generation, followed by a partial second."

The results of spraying operations during 1913–14 have been previously noted (E. S. R., 31, p. 252).

Sorosporella uvella and its occurrence in cutworms in America, A. T. Speare (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 6, pp. 189–194, pl. 1, fig. 1*).—This preliminary paper reviews the present status of knowledge of the fungus parasite *S. uvella* (*agrotidis*), records its presence in the United States, and presents some evidence to show that it is not entomophthoraceous.

The form was originally described from Russia in 1886 as *Tarichium uvella*, but there are no records of its occurrence in Europe since 1888. The report by Gibson of its occurrence in Ottawa, Canada, is said to be the only American record (E. S. R., 34, p. 251). The author's observations of its morphology and cultural characteristics here reported are based upon parasitized larvæ and a pupa of a cutworm (*Euxoa tessellata*) collected at College Park, Md., in June and July.

Observations on the Lestophonus, a dipterous parasite of the cottony cushion scale, H. S. Smith and H. Compere (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 10, pp. 384–390, figs. 9*).—*Cryptochætum monophlebi*, popularly known in California as the Lestophonus, is an important adjunct in the control of the cottony cushion scale in California. In the present paper the author reports upon the discovery of this parasite in Australia and its introduction into California, its distribution and abundance in California, and its biology. It is common in Los Angeles, Orange, San Diego, Santa Barbara, and Sacramento counties, and fairly so in Santa Clara County. While by nature it is more erratic than Vedalia, at times it becomes very abundant, occasionally infesting more than 90 per cent of the scale. There are five or six generations of the parasite during the year.

Observations on the life history of Pterodontia flavipes, J. L. King (*Ann. Ent. Soc. Amer., 9 (1916), No. 3, pp. 309–321, pls. 2*).—A report of a study of the biology of this dipteran, the larvæ of which parasitize spiders, an epeirid (*Epeira sericata*), and a lycosid, probably *Lycosa pratensis*.

Anopheles infectivity experiments.—An attempt to determine the number of persons one mosquito can infect with malaria, M. B. Mitzmain (*Pub. Health Rpts. [U. S.], 31 (1916), No. 35, pp. 2325–2335, pls. 2*).—A series of 17 infectivity experiments (E. S. R., 35, p. 759) in which human beings were employed to test the infectibility of *Anopheles punctipennis* with *Plasmodium vivax* resulted in 14 cases of malarial fever. "The sporozoites in the mosquitoes used developed 10 to 22 days after the definitive hosts were given an opportunity to bite a patient harboring a scanty number of mature tertian gametocytes.

"In an attempt to infect several persons with a single specimen of *A. punctipennis*, one mosquito proved to be the sole infective agent in one experiment, and one proved to be the sole infective agent in three experiments. These two specimens when applied to the same person transmitted the infection in five cases, while one of them used with a third mosquito succeeded in infecting four persons.

"In these experimental inoculations it was demonstrated that in nine instances in which two mosquitoes succeeded in transmitting malaria at least one of the pair was capable of causing the disease when used singly. It was demonstrated in 11 experiments that short exposure to bites was sufficient to cause successful transmission of the disease. In all of the successful inoculations only tertian infection was reproduced. *P. vivax* was demonstrated microscopically."

Wireworm control, J. N. French (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 6, pp. 225–235, figs. 3*).—Wireworm injury in the Oxnard district of California is said to be confined from a commercial standpoint almost entirely to the beet and bean crops, $100,000 being a conservative estimate of the damage done during the season of 1914. The injury during 1915, due to the warm weather which prevailed during the growing season and to the control work, was reduced to about half that amount. *Limonius californicus* was the most injurious species, though at least three others were found associated with it in some instances.

The present paper reports upon control work carried on in this district during the years above mentioned. The work with poison baits proved entirely unsatisfactory. In soil fumigation work it was found that a very small dose of cyanid would kill the pest, provided it was put into the soil below the worms and the top of the ground packed to hold the gas, but the destruction in every case was slow, requiring from three to seven days. There was practically no difference in the action of cyanid in solution and that used in the powdered form, and there was comparatively little difference between the results obtained with the stronger doses and with the weaker ones.

Of the control measures tested, which included the use of poisoned baits and deterrents, soil fumigation, and catch crops against the larvæ, fall plowing against the pupæ, and the straw-trap method for the adult, the author has found the straw method of catching the beetles to be the most promising from the standpoint of permanent success. In combating the worms, the potato catch crop method is recommended in preference to the cyanid method, because it is much cheaper and has also been more thoroughly worked out and tested on a much larger scale. A combination of the straw-trap method working against the beetles and the potato catch crop method against the worms should be especially effective.

Powder-post damage by Lyctus beetles to seasoned hardwood, A. D. Hopkins and T. E. Snyder (*U. S. Dept. Agr., Farmers' Bul. 778 (1917), pp. 20, figs. 13*).—This publication describes methods which have been found effective in preventing the losses caused by Lyctus beetles, with a view to inducing a more general adoption of them throughout the country, as well as to show the character and extent of the damage. A revision of the family, including notes on their habits, has previously been noted (E. S. R., 25, p. 261).

Foul brood regulations, F. B. Paddock (*Texas Sta. Circ. 14 (1916), pp. 3–5*).—These regulations, which supplement those of Circular 11 previously noted (E. S. R., 34, p. 657), became effective on September 1, 1916.

The Texas foul brood law and foul brood regulations, F. B. Paddock (*Texas Sta. Circ. 17 (1916), pp. 20*).—This circular brings together the text of the Texas foul brood law and the several regulations since promulgated,

including those which became effective on March 1, 1917, thus superseding Circulars 8 and 11 (E. S. R., 34, pp. 454, 657) and Circular 14 noted above.

The Cresson types of Hymenoptera, E. T. CRESSON (*Mem. Amer. Ent. Soc. No. 1 (1916), pp. 141*).—This paper contains a complete list of the species of Hymenoptera described by the author, arranged alphabetically under each family, with reference to the original description, sex, number of the type specimen, locality and condition of the specimen, etc. Types of 2,737 species are given in the list. A list of the entomological writings of the author arranged in chronological order is appended.

Tetrastichus bruchophagi, a recently described parasite of Bruchophagus funebris, T. D. URBAHNS (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 7, pp. 277–282, pl. 1*).—This is a report of studies made in California of *T. bruchophagi*, described by Gahan (E. S. R., 31, p. 355), which is the most important of several new parasites which attack *B. funebris* in alfalfa seed (E. S. R., 32, p. 454) throughout the alfalfa seed-growing districts of central California. *T. bruchophagi* is a parasite of considerable importance in these districts, having destroyed in 1913 about 52 per cent of the chalcis fly larvæ infesting alfalfa seed. This parasite is known to occur in other States as far east as Virginia.

While normally an external parasite it has in several instances been found completely inclosed within the host larva. It has not been observed to parasitize the pupal stage. This parasite hibernates in the larval stage within infested seeds of alfalfa in which it has attacked its host. It appears to be the first parasite of this host to appear in the fields in early spring, and is one of the first to transform to the pupal stage and emerge as adult with the approach of warm spring weather.

The eggs are deposited on the surface of the host larva, the ovipositor being forced into the seed pod and infested seed. Under the most favorable conditions the development of the larva does not require more than 10 days, the prepupal stage about 48 hours, and the pupal stage an average of 17.7 days. Where conditions are favorable there are from two to four generations in a single season, although under the less favorable hot and dry desert conditions the species frequently has only a single generation in a season.

Note on Rhogas kitcheneri, L. H. GOUGH (*Trans. 3. Internat. Cong. Trop. Agr. 1914, vol. 1, pp. 433, 434, pls. 2*).—A report of further observations of this parasite of *Earias insulana* and *Ephestia cautella* (E. S. R., 32, p. 156).

Structure of the egg and early stages of development in some hymenopterous parasites, F. SILVESTRI (*Bol. Lab. Zool. Gen. e Agr. R. Scuola Sup. Agr. Portici, 10 (1915), pp. 66–88, pls. 6, figs. 3; abs. in Jour. Roy. Micros. Soc., No. 3 (1916), pp. 290, 291*).—The author reports studies made of five species of Chalcididæ, namely, *Encyrtus mayri* which parasitizes the eggs of the lepidopteran *Oecophyllembius neglectus; Encarsia partenopea* and *Prospaltella (Doloresia) coniugata* which parasitize species of Aleyrodes; *P. berlesei* which parasitizes the female of the West Indian peach scale; and *Anaphoidea luna* which parasitizes the eggs of *Phytonomus variabilis*.

FOODS—HUMAN NUTRITION.

Changes in fresh beef during cold storage above freezing, R. HOAGLAND, C. N. MCBRYDE, and W. C. POWICK (*U. S. Dept. Agr. Bul. 433 (1917), pp. 100, figs. 2*).—The investigation here reported was undertaken to study the changes in fresh beef when stored at temperatures above freezing, with special reference to the effect of such changes upon the wholesomeness of the product; to determine the causes of the changes taking place under the above conditions; and to

determine the length of time that fresh beef could be held in cold storage at temperatures above freezing and remain in wholesome condition. Three distinctive lines of investigation were planned—autolysis experiments with fresh beef, cold-storage experiments with fresh beef, and a study of the factors affecting the length of time that beef could be held in cold storage.

The results of the aseptic autolysis experiments showed the following: Physical changes were not marked and consisted chiefly of a slight softening of the tissues, an exudation of juice, and a change in color of the meat. Total soluble extract or total solids decreased early in the experiments and later increased, while the ash of the extract showed appreciable although not regular increases, which corresponded roughly with similar increases in the total soluble phosphorus. The acidity of the samples showed appreciable increases toward the close of the experiment. The changes taking place in the nitrogenous compounds consisted in general of an increase of total soluble nitrogen and a conversion of the higher forms of soluble nitrogen compounds into simpler combinations. Appreciable increases were noted in total soluble phosphorus and in soluble inorganic phosphorus, together with corresponding decreases in insoluble and in soluble organic phosphorus. There was no development of free hydrogen sulphid during the course of the experiment.

The cold-storage experiments with fresh beef included bacteriological and histological studies and also physical and chemical studies of the meat during storage. The following conclusions are drawn from the bacteriological and histological tests:

"Certain bacteria (chiefly micrococci) may be normally present in the carcasses of healthy animals slaughtered for beef. These bacteria possess no pathological significance and do not appear to multiply in the cold-stored carcasses, provided the cold-storage room is maintained at the proper temperature. Bacteria and molds grow on the surface of cold-storage carcasses but do not penetrate to any great depth (less than 1 in. in 177 days); bacteria apparently are not concerned in the changes leading to increased tenderness in cold-stored meats. Microscopic sections failed to show any noticeable histological changes in the muscular tissue after 77 days of storage."

"The chemical changes that took place in the muscular tissue of beef held in cold storage at temperatures above freezing for periods ranging from 14 to 177 days consisted chiefly in increases in acidity; in proteose, noncoagulable, amino, and ammoniacal nitrogen; and in soluble inorganic phosphorus; while decreases occurred in coagulable nitrogen and in soluble organic phosphorus. On the whole these changes were of a progressive nature. The chemical changes that took place in the fatty tissues of the beef consisted chiefly in marked increases in the acidity of the kidney and external fats."

These changes were similar in nature to, but less in extent than, those caused by enzymatic action when lean beef underwent aseptic autolysis for periods ranging from 7 to 100 days.

"The chemical changes that took place in the muscular tissue of the beef during storage were without appreciable effect either upon the nutritive value or the wholesomeness of the edible portions of the product; but the changes that took place in the kidney fat and external fatty tissue after the longer periods of storage rendered them unsuitable for human consumption. . . .

"The chemical changes which took place in the muscular tissues of the beef during storage may be regarded as largely due to enzym action.

The principal effect of storage upon the organoleptic properties of the beef was a marked increase in tenderness of the meat. This change did not appear to progress appreciably after the beef had been held in storage for from two to four weeks. While the flavor also changed, individuals would

probably not agree as to whether the change was in the nature of an improvement or a deterioration.

"On the whole it would appear that the chemical changes that occurred during the storage of beef in these experiments did not appreciably affect the nutritive value of the meat when the period of storage was limited to that customarily employed in commercial practice. Indeed, even when the period of storage was greatly prolonged, evidence is lacking to show that the nutritive value of the meat was diminished. Yet, in view of the more extensive chemical changes that took place during the longer periods of storage and on account of the deficiency of our knowledge regarding the nutritive values of the various cleavage products, it is by no means impossible that the nutritive value of beef may be decreased by unduly long periods of storage. . . .

"Beef was held in cold storage at temperatures above freezing in an experimental cooler for as long as 177 days, whereas it was possible to hold beef in storage in a cooler in a modern packing house for only 55 days. The shorter storage period in the second instance was due to the much higher humidity of the packing-house cooler as compared with the experimental cooler.

"The length of time that fresh beef can be held in cold storage at temperatures above freezing and remain in wholesome condition is dependent upon a number of factors, among which the temperature and humidity of the storage room and the character of the beef are of the most importance.

"In light of the various factors that affect the length of time that fresh beef can be held safely in cold storage at temperatures above freezing, it is clearly impracticable to attempt to insure the wholesomeness of the product merely by limiting the duration of storage. The wholesomeness of cold-stored beef must be judged by other considerations besides the length of time that the product has been held in cold storage."

Eggs and their value as food, C. F. Langworthy (*U. S. Dept. Agr. Bul. 471 (1917), pp. 30, figs. 3*).—This bulletin summarizes data regarding the nature, food value, and uses of eggs, and the effects of handling, storing, and marketing eggs upon their value in the household. It is essentially a revision of Farmers' Bulletin 128 (E. S. R., 13, p. 166), the material contained therein having been brought up to date and presented in a somewhat different form.

Practical milling tests, E. F. Ladd (*North Dakota Sta. Circ. 15 (1917), pp. 11, figs. 4*).—This investigation was carried on to determine whether or not the milling tests made with the experimental mill at the college represented the results which are obtained in the commercial milling of wheat. Data are given regarding the milling of wheat at a small commercial mill doing a grist business and also regarding comparative milling and baking tests made at the station on samples of wheat obtained from the mill.

It was found that the results at the commercial grist mill did not differ materially from those at the experimental mill. The higher percentage of total flour obtained at the experimental mill was ascribed to the better cleaning-up at the end of each cut-off than in the case of the commercial grist mill.

The distribution of chlorin in cereals and dry legumes, Balland (*Jour. Pharm. et Chim., 7. ser., 15 (1917), No. 4, pp. 105–107*).—The experimental method by which chlorin in cereals and dry legumes was determined is briefly described. Data are given regarding the chlorin content of a number of cereals and dry legumes.

Recipes for the preparation of the dasheen (*U. S. Dept. Agr., Bur. Plant Indus. [Circ.], 1916, pp. 4*).—Suggestions are given for the preparation of dasheens, together with a compilation of recipes.

[Food and drug inspection], E. F. Ladd and Alma K. Johnson (*North Dakota Sta. Spec. Bul., 4 (1917), No. 10, pp. 243–258, fig. 1*).—Analytical data are reported regarding several samples of miscellaneous foods and drugs. The results are reported of the inspection of grocery stores, meat markets, restaurants, etc., and miscellaneous information regarding various pure-food topics is included.

Eighth annual report of the board of food and drug commissioners (*Ann. Rpt. Bd. Food and Drug Comrs. R. I., 8 (1916), pp. 35*).—The work of the commission during the year ended December 31, 1916, is summarized. It included the inspection of a large number of samples of miscellaneous foods and drugs.

Report of the Dairy and Food Department [of Iowa], W. B. Barney (*Rpt. Dairy and Food Dept., Iowa, 1916, pp. 72, figs. 12*).—This publication reviews the work of the department for the year ended October 31, 1916. This included the examination of 4,479 samples of foods, drugs, stock feeds, paints, and oils; the examination of 14,356 samples of milk and cream; and the inspection of a large number of establishments where foods are prepared and sold, as well as the routine inspection of weights and measures. The publication contains considerable information on the relative value and cost of different foods and a report of the work of the Iowa State Dairy Association for 1916.

A discussion of a simple steam sterilizer for farm dairy utensils is also included. Directions are given for the construction and operation of this sterilizer.

A summary of the market situation in Boston, P. T. Cherington et al. (*Boston City Doc. 118 (1916), pp. 175, figs. 19*).—This is a preliminary report of the Market Advisory Committee to the Boston City Planning Board. It includes a summary of the work done, and embodies several suggestions for detailed study along three lines, which include investigations of a general nature, a study of retail markets, and a study of wholesale markets, including terminal problems.

The appendix of the report contains the following material: Sources of and Methods of Handling Perishable Food Products in the Boston Market, by T. C. Huff and W. E. Lusby; Summary of Some of the Main Features of the Organization of Boston's Fruit and Produce Trade, by T. C. Huff; A Study of a Public Market System for Boston, by E. D. Pratt, C. P. Putnam, and E. A. Teeson; A Study of the Eight Agencies by Which the Perishable Food Supply of Boston is Retailed, by the Women's Municipal League, Mrs. W. M. Wheeler, assisted by Suzanne Wunderbaldinger and numerous investigators; and A Study of Some of the Effects of Cold Storage on the Egg Trade of Boston, 1904–13, by A. C. James. It also contains tables of miscellaneous statistics regarding food receipts, food prices, eggs, cold-storage data, etc.

The report is concluded by a bibliography compiled by C. C. Williamson, which includes 28 pages of references on markets and marketing, cost of living and food prices, municipal slaughterhouses and meat supply, cold storage of food products, transportation and distribution of food products, and cooperation, with special reference to food products; and an outline of study adopted by the subcommittee as its plan of work.

Education in economy [of foods], C. A. Spooler (*Pomona, Cal.: Author, 1917, pp. 248, pls. 22*).—This book contains information regarding the selection of meats, poultry, fish, and provisions, together with suggestions regarding their preparation for the table. The book is illustrated by a number of plates showing the different cuts of meat.

Planning of meals, Lelia McGuire (*Agr. Col. Ext. Bul. [Ohio State Univ.], 12 (1916–17), No. 3, pp. 16*).—A popular treatise on food requirements and food selection for variety, which contains suggested menus.

Misguided appetite and the high cost of living, A. E. PERKINS (*Mo. Bul Ohio Sta., 1 (1916), No. 12, pp. 363–370, fig. 1*).—A more or less popular article dealing chiefly with the food requirements of the body and the use of milk and skim milk in the diet.

Electrical cooking and heating, EDNA GROVES (*Jour. Electricity, 38 (1917), No. 4, pp. 116–118, fig. 1*).—This article discusses essentially cost data.

[Report of the] nutrition laboratory, F. G. BENEDICT (*Carnegie Inst. Washington, Year Book 15 (1916), pp. 273–285*).—The work of the laboratory during the year 1916 is reviewed. Various additions to the laboratory equipment are described and brief outlines are given of the investigations in progress. The latter include a study of metabolism during muscular work, metabolism in rectal feeding with alcohol and simple sugars, the influence of moderate amounts of alcohol on psychological processes, metabolism in diabetes, metabolism of normal infants, influence of environmental temperature on metabolism, etc. A list of the publications issued by the laboratory during the year is given, together with brief abstracts of the same.

On the rôle of organic acids in the process of peptic digestion, I. V. BELGOWSKY (*Zap. Selsk. Khoz. Inst. Imp. Petra I (Mem. Inst. Agron. Emp. Pierre I), 1 (1916), pp. 70–100*).—This publication reports experiments carried out to determine whether or not an acid medium is necessary for a normal course of digestion and whether the activity of the peptic ferment is possible only in the presence of acids. It was also desired to obtain some information on the rôle of the various acids in digestion.

From the experimental data reported the conclusion is drawn that lactic, butyric, propionic, acetic, and valerianic acids, present in the digestive juice in a quantity corresponding to 0.25 per cent of hydrochloric acid, can not replace the latter. With reference to the influence of organic acids on pepsin, it is stated that the acids are more or less passive as regards albumin, and in some cases butyric acid decreases the activity of the pepsin.

Pellagra (*Kansas City, Mo.: Burton Publishing Co., 1916, pp. 362, figs. 49*).—The first part of this publication contains a contribution to the etiology and pathogenesis of pellagra by G. Alessandrini and A. Scala, which has been translated from the Italian by E. M. Perdue. This reports the results of animal experiments and other data, from which the authors concluded that pellagra "is the effect of a chronic intoxication which is caused by silica in colloidal solution in water of determinate compositon, and, therefore, may be also defined as a disease caused by colloidal minerals."

The second part of the publication is a review of the pellagra situation in the United States, which is considered from the theory of colloidal silica brought out in the earlier part of the publication. The subject matter of this book is not in accordance with the generally accepted results of workers on pellagra in this country.

Studies in pellagra (*Pub. Health Serv. U. S., Hyg. Lab. Bul. 106 (1917), pp. 5–102, pls. 7*).—Three papers are presented.

I. *Tissue alteration in malnutrition and pellagra*, by J. Sundwall (pp. 5–73, pls. 7).—The results are reported of the examination of tissue obtained at necropsies of pellagrins and of tissue obtained at autopsies of certain animals which had been fed various diets with a view to producing, if possible, symptoms and tissue changes which are found in pellagra. The conclusion is drawn from these observations that the tissue alterations, including the degenerative changes in the nervous system occurring in the animals as a result of malnutrition, were strikingly similar to those observed in pellagrous tissue. The author states that there could be no objection from a pathological standpoint to the classification of pellagra along with rickets, scurvy, and beri-beri as a

dietary disease. Rigid examination of tissues from pellagrins revealed no micro-organism that could be regarded as a specific etiological factor.

"Pellagra, then, possesses no characteristic cell alterations, but the pathological changes are those resulting from malnutrition. Consequently, it is erroneous to assume that certain substances such as silicates, aluminates, etc., are the etiological factors of pellagra, as some have done, because of the pathological changes that have been induced as a result of the administration of these substances. . . .

"The pathological changes in tissues in malnutrition are very similar, whether resulting from (a) no food, (b) unbalanced diets, (c) mild circulating toxins which interfere with nutrition of cells. In (a) congestion and fatty degeneration were more pronounced, while in (b) more pigment (hemosiderin) was present."

A bibliography is appended.

II. *Cultivation experiments with the blood and spinal fluid of pellagrins*, by E. Francis (pp. 75–80).—Anaerobic cultivation was carried out on the blood of 21 pellagrins and on the spinal fluid of 16 pellagrins. "The results of the examination of the cultures were negative; the cultures either remained sterile or an occasional tube showed a growth which was evidently a contamination."

III. *Further attempts to transmit pellagara to monkeys*, by E. Francis (pp. 81–102).—Attempts to transmit pellagra to laboratory animals (monkeys) by the inoculation of various materials obtained from pellagrins are reported. Of the 94 animals experimented upon only one showed any indications which even suggested pellagra. This exceptional case is described in detail, and the author states that the results of this investigation furnished no support for the view that pellagra is an infectious disease.

The production in dogs of a pathological condition which closely resembles human pellagra, R. H. Chittenden and F. P. Underhill (*Proc. Nat. Acad. Sci., 3 (1917), No. 3, pp. 195–197*).—By feeding laboratory animals (dogs) upon a diet consisting of boiled dried peas, cracker meal, and cottonseed oil or lard a diseased condition which closely resembled human pellagra was produced. The ingestion of suitable quantities of meat caused these symptoms to disappear.

The intake of a large quantity of peas was found to be less detrimental than smaller amounts. It was more difficult to produce these symptoms in the animals when a diet containing meat, cracker meal, and lard was fed, and for the production of the diseased condition the meat intake had to be reduced to a certain undefined minimum.

The conclusion is drawn that the abnormal condition is due to a deficiency of some essential dietary constituent or constituents.

ANIMAL PRODUCTION.

Palm kernel cake, C. Crowther (*Jour. Bd. Agr. [London], 23 (1916), No. 8, pp. 734–749*).—This gives a summary of investigations by others at the University of Leeds upon the merits of palm nut kernel cake and meal as a feeding stuff.

On account of the difficulties of mastication and swallowing of palm kernel cake due to its grittiness cattle and sheep did not readily take to this feed. These difficulties were overcome where the palm kernel cake was fed with twice its weight of other cake. In laboratory and farm tests, palm kernel cake compared favorably in keeping quality with most of the oil cakes used on the farm. In digestion experiments with sheep, palm kernel cake gave the following average percentages of digestibility: Total dry matter 74.2, organic matter 75.9, protein 91, fat 97.5, nitrogen-free extract 83.1, and crude fiber 37.1. The

corresponding percentages for palm kernel meal were 75.5, 76.7, 90, 96.4, 86, and 44.8; and for undecorticated Egyptian cottonseed cake 57.7, 58, 74.7, 100 (?), 62, and 34.9. The composition and estimated digestible nutrients of these feeds are given.

In an experiment with five cows a slight increase in the fat content of the milk was produced on feeding palm kernel cake. This increase was more pronounced in the evening milk than in the morning milk, and varied greatly with individual cows. From an examination of samples of the milk fat of two of the cows in this test it was concluded that the feeding of palm kernel cake exercised an effect upon the composition of the milk fat such as might be obtained by the passage of some ingredients of palm kernel oil into the milk fat.

Commercial feeding stuffs, A. J. PATTEN, E. F. BERGER, A. E. SMOLL, and E. A. DE WINDT (*Michigan Sta. Bul. 276 (1916), pp. 3–72*).—In addition to notes on the requirements of the state feeding stuffs law, results are tabulated of the analyses of 1,060 samples of feeding stuffs collected in the State during 1916, including cottonseed meal, cottonseed feed, linseed meal, flaxseed meal, distillers' dried grains, brewers' dried grains, gluten feed, gluten meal, hominy feed, corn feed meal, cracked corn, blood and bone meal, meat meal, meat scrap, digester tankage, granulated bone, beef scrap, alfalfa meal, wheat bran, barley bran, pea bran, wheat, oat, and rye middlings, and mixed and proprietary feeds.

Commercial feeding stuffs, 1915–16, [and] Texas feed law, B. YOUNGBLOOD (*Texas Sta. Bul. 194 (1916), pp. 5–351*).—Analyses are given of cottonseed meal, cottonseed cake, cold pressed cottonseed, cold pressed cottonseed (made from bolly seed), linseed meal, peanut meal, peanut cake, corn feed meal, corn chop, corn bran, hominy feed, milo maize chop, milo maize meal, Kafir corn chop, Kafir corn meal, feterita chop, wheat bran, wheat shorts, barley chop, rolled barley, crushed oats, rice polish, rice bran, cowpea and hull chops, alfalfa meal, dried beet pulp, dried brewers' grains, distillers' grains, fish meal meat scrap, meat meal, digester tankage, bone chop, and various mixed and proprietary feeds, together with other useful data. The text of the law regulating the sale of feeding stuffs in Texas is included.

Sheep husbandry in Oklahoma, W. L. CARLYLE and D. A. SPENCER (*Oklahoma Sta. Bul. 111 (1916), pp. 3–47, figs. 12*).—This bulletin treats in a general way of the sheep industry of Oklahoma, breeds of sheep, management of the farm flock, and common sheep troubles and their treatment, and gives results of a number of feeding experiments with sheep at the station, together with general directions for fattening and marketing sheep.

Notes are given on the progress of an experiment started at the station in 1909 in which an effort is being made to produce a type of sheep suitable for Oklahoma conditions by crossbreeding Dorsets, Shropshires, and Merinos.

The station produced 46 early lambs in the fall of 1913 and sold several of them on the Easter market in Kansas City in the spring of 1914. The total cost of producing the lambs at the farm was $4.60 per lamb. The freight and commission charges averaged 70 cts. per lamb, making the average total cost per lamb by the time they were placed on the market $5.30. The receipts per lamb were $7.

In a feeding experiment during the winter of 1912–13 a lot of six ewes consuming an average of 4.94 lbs. of silage and 0.51 lb. of cottonseed meal per head daily made an average daily gain of 0.39 lb. per ewe for 49 days. During the same period another lot of six ewes on an average daily ration of 2.97 lbs. of alfalfa hay and 0.98 lb. of corn chop made an average daily gain of 0.53 lb. per ewe. No difference could be observed in the health and vigor of the ewes and lambs in the two lots.

In a test in 1914–15, comparing cottonseed meal with alfalfa hay as supplements for cane silage for breeding ewes, a lot of ten ewes fed an average daily ration of 5.85 lbs. of cane silage and 0.5 lb. of cottonseed meal, made an average daily gain of 0.4 lb. per ewe for 105 days. During the same period another lot of ten ewes fed an average daily ration of 4.87 lbs. of cane silage and 1.5 lbs. of alfalfa hay gained 0.16 lb. per ewe daily. The nine ewes that lambed in lot 1 gave birth to 13 lambs, three of which were strong, six of medium vigor, two were weak, and two were born dead. Only eight ewes lambed in lot 2, and from these eight were nine lambs, five of which were strong, two of medium vigor, one weak, and one dead.

A comparison was made of ewes of different breeds and crosses on a maintenance ration of alfalfa hay and corn and Kafir corn silage in 1915–16. The experiment lasted from 79 to 84 days for the different lots. The average daily gain and feed cost per ewe for the different lots were as follows: Lot 1, consisting of nine pure-bred Shropshire and four cross-bred Shropshire-Merino ewes, 0.107 lb. and 1.76 cts.; lot 2, consisting of 17 pure-bred Dorset ewes, 0.19 lb. and 1.91 cts.; lot 3, consisting of eight pure-bred American Merino and five pure-bred Rambouillet ewes, 0.193 lb. and 1.71 cts.; lot 4, consisting of 12 F_1 Shropshire-Dorset ewes, 0.202 lb. and 1.84 cts.; lot 5, consisting of 10 F_1 Merino-Dorset ewes, 0.19 lb. and 1.89 cts.; and lot 6, consisting of 15 ewes that were the offspring of pure-bred rams and cross-bred ewes, 0.16 lb. and 1.65 cts. No conclusions are drawn from this experiment.

In an experiment comparing corn silage with alfalfa hay as roughage for fattening lambs a lot of six pure-bred and cross-bred wether lambs fed an average daily ration of 3.18 lbs. of silage and 2.03 lbs. of a mixture of Kafir corn and cottonseed meal (2:1 by weight) gained 0.42 lb. per head daily for 63 days at a cost of 6.82 cts. per pound of gain. During the same period another lot of six wether lambs of the same breeding, on an average daily ration of 2.88 lbs. of alfalfa hay and 2.03 lbs. of the above grain mixture, gained 0.55 lb. per head daily at a cost of 7.53 cts. per pound of gain. The market finish of both lots was practically the same. In another test beginning October 22, 1913, 30 pure-bred and cross-bred lambs averaging about 92 lbs. per head were divided into two lots of 15 lambs each and fed for 49 days. These lambs had received grain on pasture and were in good condition. Lot 1, on a mixture of Kafir corn silage, alfalfa hay, and corn chop, made an average daily gain of 0.69 lb. per lamb at a cost of 3.96 cts. per pound of gain. Lot 2, fed the same mixture as lot 1 and in addition 0.234 lb. of cottonseed meal per head daily, made an average daily gain of 0.62 lb. per lamb at a cost of 4.24 cts. per pound of gain.

In another test with 20 pure-bred Shropshire lambs, cottonseed meal was compared with alfalfa hay as supplements for cane silage and Kafir corn chop. The ten lambs receiving an average daily ration of 2.95 lbs. of silage, 1.19 lbs. of Kafir corn chop, and 0.49 lb. of cottonseed meal made an average daily gain of 0.35 lb. per head for 84 days at a cost of 7.11 cts. per pound of gain. During the same period, the ten lambs fed 3.02 lbs. of silage, 1.13 lbs. of alfalfa hay, and 1.23 lbs. of Kafir corn chop per head daily, made an average daily gain of 0.46 lb. per lamb at a cost of 5.74 cts. per pound of gain.

Sheep husbandry in the Pacific Northwest, W. Hislop and C. E. Howell (*Washington Sta. Bul. 134 (1917), pp. 3–24, figs. 12*).—This bulletin, which is based upon replies to a circular letter sent to the members of the Washington Wool Growers' Association, gives information as to the actual range practice in the sheep industry in the Pacific Northwest. The answers received represent 201,010 head of ewes, approximately one-half of the sheep population of the State. Of these 85 per cent have a foundation of Merino blood. Of the ewe

flocks 14.3 per cent were Lincolns. Lincoln rams are being used by 44.2 per cent of the breeders reporting, Shropshire rams by 32.6 per cent, Hampshire rams by 23.09 per cent, and Rambouillet rams by 7.6 per cent.

The lambing percentage varied from 70 to 130, the average being 92.32. The weight of the lambs when they reached market varied from 60 to 85 lbs., the average being 73.5 lbs. The weight of fleece of the ewes varied from 7 to 11 lbs., the average being 9.5 lbs. In reference to the annual cost of keeping a ewe, one man who has a band of 2,000 ewes estimated that it cost 75 cts. per ewe. This was the lowest estimate given. The highest was $5, and the average $2.59.

Other topics summarized are number of ewes per ram, time of weaning lambs, time and place of marketing lambs, the wool market, causes of death in range sheep, and kind of feed used.

Experiments in the disposal of irrigated crops through the use of hogs, J. A. HOLDEN (*U. S. Dept. Agr. Bul. 488 (1917), pp. 25, figs. 3*).—This bulletin reports in detail experiments conducted from 1912 to 1915, inclusive, at the Scottsbluff experiment farm in western Nebraska, for the purpose of obtaining information on the practicability of using alfalfa as hog pasture, the value of different quantities of grain when fed to hogs on alfalfa pasture, the comparative values of corn and ground barley when fed to hogs on alfalfa pasture, and the practicability of hogging down corn. Progress reports of these tests have been noted (E. S. R., 36, p. 170).

Summarizing the whole series of experiments, it is stated that "in three years' experiments, including eight lots of hogs, in which alfalfa pasture was supplemented with a 2 per cent ration of corn, an average gain of 3,181 lbs. per season was made from an acre of alfalfa pasture and 7,844 lbs. of corn. It required an average of 2.47 lbs. of corn in addition to alfalfa pasture to produce 1 lb. of pork. If the gains are valued at 7 cts. a pound and corn at 60 cts. a bushel, or $1.07 a hundredweight, the average annual return was $138.75 per acre of alfalfa pasture. If the corn fed is valued at 60 cts. a bushel and the alfalfa pasture at $15 an acre the average cost of 100 lbs. of gain was $3.11. If the average yield of the alfalfa plats in the same field is assumed to represent the yield of the pastured plats the hogs paid an equivalent of $25.13 per ton of hay.

"In two years' experiments with alfalfa pasture, with and without supplemental feed, an average annual return of $45.08 per acre was secured where no supplement was used, as compared with $70.20 where a 1 per cent ration of corn was used, $128.49 from a 2 per cent ration of corn, $121.96 from a 2 per cent ration of barley, and $168.25 from a 3 per cent ration of corn. The rate of gain and the carrying capacity of the pasture increased with the quantity of grain fed. Ground barley appeared to be as good, pound for pound, as shelled corn as a feed for hogs on alfalfa pasture.

"Sows and pigs on alfalfa pasture, with a 2 per cent ration of grain, made an average gain of 1,574 lbs. per acre of alfalfa pasture from May 1 to July 1, or a net return of $66.84 per acre. When corn was used the return varied from $54.11 to $69.97 per acre, and when barley was used the return was $77.76 per acre.

"In three years' experiments, hogging corn without supplementary feed produced an average of 896 lbs. of gain, worth $65.72 per acre, or $1.50 per hundredweight of the estimated yield of corn.

"In two years' experiments, hogging corn without supplementary feed produced an average of 744 lbs. of gain, worth $52.08 per acre, as compared with 930 lbs. of gain, worth $65.10, where the hogs had access to alfalfa pasture, and 1,029 lbs. of gain, worth $72.03, where the hogs were fed tankage in addition to the corn. Where no supplementary feed was used the hogs paid $1.34 per hun-

dredweight for the estimated yield of corn, as compared with $1.55 per hundredweight where the hogs had access to alfalfa pasture, and $1.50 per hundredweight where tankage was used. The use of either alfalfa or tankage resulted in more rapid and cheaper gains than were secured where no supplementary feed was used."

Fattening swine on rice by-products, H. E. DVORACHEK ET AL. (*Arkansas Sta. Bul. 128 (1916), pp. 24, fig. 1*).—Results are reported of five experiments carried on at the station to determine the relative feeding values of corn, rice polish, and rice bran for fattening swine when fed alone, in various combinations, and when supplemented with various protein supplements. The pigs were fed in pens in the station hog house and had access to dry lots, mineral matter, and water. In the first three experiments the feeds were mixed with water at the time of feeding and fed as a thick slop. In the fourth and fifth experiments the full day's feed was mixed with water in barrels in the evening, one-half of this mixture being fed the next morning and the other half the next evening. The cost of gains was based upon the following prices per hundredweight for feeds: Corn chop, $1.50; rice polish, $1.40; rice bran, $1.10; wheat shorts, $1.40; tankage, $2.50; skim milk, 25 cts.; and buttermilk, 25 cts.

The following table gives the rations fed and some of the results obtained in the five experiments:

Pig feeding trials.

Experiment No.	Lot No.	Rations fed; weight proportions.	Average daily gain per head.	Feed consumed per pound of gain.	Cost per pound of gain.	Length of experiment.	Average weight per pig at beginning.	Number of pigs per lot.
			Pounds.	*Pounds.*	*Cents.*	*Days.*	*Pounds.*	
I	1	Corn chop, tankage (9 : 1)	1.17	4.358	6.97	75	130	6
	2	Rice polish, tankage (9 : 1)	1.23	3.754	5.67			
	3	Rice bran, tankage (9 : 1)	1.27	4.488	5.56			
	4	Rice polish, rice bran, tankage (9 : 9 : 2)	1.16	4.920	6.77			
	5	Corn chop, rice polish, rice bran, tankage (3 : 3 : 3 : 1)	1.39	4.311	6.25			
	6	Rice polish, rice bran, tankage (6 : 3 : 1)	1.26	4.018	5.72			
II	1	Corn chop, tankage (9 : 1)	1.48	3.782	5.96	82	85	5
	2	Rice polish, tankage (9 : 1)	1.26	3.636	5.49			
	3	Rice bran, tankage (9 : 1)	1.28	4.478	5.55			
	4	Rice polish, rice bran, tankage (9 : 9 : 2)	1.16	3.991	5.48			
	5	Corn chop, rice polish, rice bran, tankage (3 : 3 : 3 : 1)	1.36	4.240	6.15			
	6	Rice polish, rice bran, tankage (3 : 6 : 1)	1.14	4.286	5.70			
III	1	Rice bran	1.10	5.272	5.80	90	110	4
	2	Rice bran, wheat shorts (1 : 1)	1.03	5.794	7.25			
	3	Rice bran, wheat shorts, tankage (6 : 3 : 1)	1.33	4.700	6.25			
	4	Rice bran, tankage (9 : 1)	1.13	5.308	6.58			
IV	1	Corn chop	1.30	4.754	7.14	63	135	5
	2	Rice bran	1.46	4.227	4.65			
	3	Rice polish	1.63	3.580	5.01			
	4	Corn chop, rice bran, rice polish (1 : 1 : 1)	1.72	3.627	4.83			
	5	Rice bran, rice polish (1 : 1)	1.40	4.044	5.05			
	6	Rice bran, rice polish (2 : 1)	1.66	3.702	4.44			
	7	Rice bran, rice polish (1 : 2)	1.49	3.903	5.07			
	8	Rice bran, rice polish (1 : 3)	1.72	3.580	4.74			
V	1	Corn chop, tankage (9 : 1 to 12 : 1)	1.21	4.136	6.57	84	75	5
	2	Rice bran, tankage (9 : 1 to 12 : 1)	1.07	4.612	5.65			
	3	Rice polish, tankage (9 : 1 to 12 : 1)	1.41	3.420	5.12			
	4	Corn chop, buttermilk	1.18	7.003	6.59			
	5	Rice bran, buttermilk	1.20	6.867	4.93			
	6	Rice polish, buttermilk	1.55	5.299	4.69			
	7	Corn chop, skim milk	1.28	8.675	6.64			
	8	Rice bran, skim milk	1.26	8.807	5.28			
	9	Rice polish, skim milk	1.64	6.749	4.90			

In the tankage lots in experiment 5 the ratio fed was 9:1 during the first six weeks and 12:1 during the last six weeks. "In the lots where skim milk and buttermilk were used a like change in proportions was made."

The authors state that "hogs scour severely when fed large quantities of rice polish when it is dampened just before feeding. The addition of lime water checked the scours. In lots where the rice polish was thoroughly soaked for 12 and 24 hours, no scouring occurred.

"These experiments were all conducted on fairly well grown shotes for fattening purposes, and no indications of incomplete nutrition were noticeable, such as have been reported by some where rice polish was used alone for growing pigs. Rice polish is not as palatable as corn chop, especially during the close of the fattening period. Hogs go off feed readily at that time. When fed with skim milk and buttermilk great gains and an excellent finish are possible."

Detailed data for each lot in the five experiments are tabulated by periods in the appendix.

Breeds of swine, F. G. Ashbrook (*U. S. Dept. Agr., Farmers' Bul. 765 (1917), pp. 16, figs. 14*).—This gives information concerning the various breeds of swine, their origin, general appearance, development, and adaptability.

How to select a sound horse, H. H. Reese (*U. S. Dept. Agr., Farmers' Bul. 779 (1917), pp. 26, figs. 36*).—This gives concise information on the selection of sound horses by thorough, systematic examination, and points out by means of illustrations how to observe blemishes, vices, faulty conformation, unsoundness, general characteristics, and the indications of age in horses.

A study of the effect of cottonseed meal v. beef scrap upon the egg production, fertility, and vitality of poultry, B. A. Ahrens (*Oklahoma Sta. Bul. 112 (1917), pp. 3–20*).—The first of these experiments with White Leghorns was begun in November, 1914. In this test there were three lots of ten pullets and two cockerels each. These birds were bred at the station from sires and dams of strong constitutional vigor. Each of the lots received a grain ration of Kafir corn and whole wheat, equal parts by weight. In addition, lot 1 received a mash of millrun, corn chop, beef scrap, and bone meal (7:6:2:1); lot 2 a mash of millrun, corn meal, cottonseed meal, and bone meal (6:6:3:1); and lot 3 a mash of millrun, corn chop, cottonseed meal, and bone meal (3:3:9:1). The nutritive ratios of the rations were, for lots 1 and 2, 1:4.5, and for lot 3, 1:3.5. The chicks hatched from the different lots were kept separate from birth and fed on the same type of ration as their parents, due allowance being made for changing the exact composition of the ration to meet the requirements of the growing period. During this test the health of the birds was excellent. One pullet from lot 3 died of roup and one male from the same lot died from the effects of being crop bound.

In a preliminary test of all eggs laid for three weeks before February 2, 1915, the following percentages of fertility were found after seven days incubation: Lot 1, 75.7; lot 2, 97.4; and lot 3, 100. The incubation records from February 2 to July 10, 1915, showed that of 711 eggs set from lot 1, 89.5 per cent were fertile, 32.8 per cent of which hatched; of 535 eggs set from lot 2, 90.8 per cent were fertile, 48.7 per cent of which hatched; and of 334 eggs set from lot 3, 87.7 per cent were fertile, 31 per cent of which hatched. From November 18, 1914, to November 17, 1915, lot 1 produced 1,394 eggs at a profit of $5.05; lot 2, 998 eggs at a profit of $1.35; and lot 3, 744 eggs at a profit of 46 cts.

During the season of 1915–16 these birds were rearranged into six lots to eliminate the effect of difference in stock, except that the birds in the original lot 3 were carried along as lot 3 in this test. Lots 1 and 4 were fed the same ration as lot 1 of the former season, lots 2 and 5 the same as lot 2 of the former season, and lots 3 and 6 the same as lot 3 of the former season.

Summarizing incubation records during the season it was found that of 250 eggs set from lot 1, 90 per cent were fertile, 55 per cent of which hatched. The corresponding figures for the other lots were as follows: Lot 2, 230, 90, and 54.1; lot 3, 206, 92.2, and 46.3; lot 4, 262, 88.5, and 56; lot 5, 197, 91.3 and 48.3; and lot 6, 243, 98.5, and 43.9. From November 18, 1915, to May 17, 1916, the hens in lot 1 laid 636 eggs at a profit of $3.40; lot 2, 552, at a profit of $2.67; lot 3, 404, at a profit of $1.63; lot 4, 730, at a profit of $6.25; and lot 5, 431, at a profit of $3.63. The egg production record of lot 6 is not given.

The author states that the mortality was much higher in the chicks from the lots fed cottonseed meal, both in the normal and excessive amounts, than in those from the lots fed beef scrap.

Analyses of each of the feeds used are given.

Cost of raising Leghorn pullets, A. G. PHILIPS (*Indiana Sta. Bul. 196* (*1916*), *pp. 20, figs. 6; popular ed., pp. 8, figs. 4*).—The experiments reported in this bulletin covered four seasons' work and involved several thousand White Leghorn chicks. The chicks were reared in 8 by 8 ft. A-shaped colony brooder houses, heated by gasoline, in yards covered with blue grass and clover. After the heat was removed, each brooder house with its chicks was moved to a lot 130 by 150 ft. planted to young fruit trees, the rows of which were intertilled with corn.

The grain ration consisted of sifted cracked corn, sifted cracked wheat, and steel cut oats, equal parts by weight, until the chicks reached a weight of 0.7 lb. each, when the grain was changed to cracked corn and whole wheat. The dry mash consisted of a mixture of bran, shorts, corn meal, and meat scrap (2:2:2:1) to which was added a small quantity of charcoal and ground dry bone. Green feed, grit, and skim milk were fed in abundance. When the cockerels weighed about 1.25 lbs. they were removed to a fattening pen and finished for market.

Detailed data of one of the five experiments are tabulated and compared with the average results of all the experiments.

It was found that the cost of a pullet up to the time of laying varies largely with feed prices. The average gross cost of raising pullets in these tests was 43.4 cts. When the profit from the cockerels was credited, the net cost of the pullets varied from 24.3 to 50.5 cts., the average being 38.1 cts. It took 1.8 eggs to produce a Leghorn chick, the cost of which when hatched was 5.7 cts. To 12 weeks of age the chicks in these tests consumed 5.96 lbs. of feed and 5.07 lbs. of milk per head, or 3.59 lbs. of feed and 3.41 lbs. of milk at a cost of 8.4 cts. per pound of gain. The average weight per pullet in the five experiments at 168 days of age was 2.75 lbs. The percentage of mortality varied from 8 to 29.5 in the different experiments, the average being 17. In these experiments 100 pullets were raised from every 457 eggs set.

Plans are given of the Purdue shed-roofed colony brooder house.

Temperature experiments in incubation, A. G. PHILIPS (*Indiana Sta. Bul. 195* (*1916*), *pp. 31, figs. 5; popular ed., pp. 8, figs. 5*).—These experiments were planned for the purpose of determining the influence of different temperatures in the incubator on brown and white eggs, the upper and lower temperature limits of artificial incubation, and the influence on temperature readings of placing thermometers at different heights in the machine.

Four 150-egg incubators were used. They were of the hot-air type, supplying heat by both radiation and diffusion, and moisture by a sand tray underneath the egg trays. The five thermometers used were standard incubator thermometers, generally known as hanging, standing, touching, and Inovo. The hanging thermometer was suspended from the top of the incubator, 2 in. above the center of the egg tray. The standing thermometer was on a metal stand in the center,

toward the front of the machine, the bulb on a level with the top of the eggs but not touching them. The touching thermometers were two in number, one on brown and one on white eggs, near the standing thermometer. The bulbs of these were on a level with the top of the eggs and touching them. The Inovo thermometer, which is supposed to register the temperature of the germ in an egg, was placed near the other thermometers.

Four experiments were made with each incubator, one in 1913, one in 1915, and two in 1916. Brown and white eggs from White Plymouth Rock and White Leghorn pullets, respectively, were used. Except in the first experiments the eggs were so selected as to eliminate all possible influences on the hatch by some particular hen or because of the age of the eggs. The machines were run at the following temperatures as registered by the standing thermometer during the first, second, and third weeks: Machine No. 1, 100, 101, 102° F.; machine No. 2, 101, 102, 103°; machine No. 3, 102, 103, 104°; and machine No. 4, 103, 104, 105°. The following table gives some of the results obtained:

Results of incubation experiments with white and brown eggs.

Machine No.	Eggs set.		Eggs infertile.		Dead germs.		Chicks dead in shell.		Chicks hatched.	
	White.	Brown.	White.	Brown.	White.	Brown.	White.	Brown.	White.	Brown
1	225	225	16	26	9	17	36	56	164	126
2	295	300	23	37	27	38	37	59	208	166
3	296	300	22	40	8	31	70	70	196	151
4	296	300	27	34	25	50	131	135	113	89

No reason from the standpoint of incubation was found for the poor showing of the brown eggs as compared with the white eggs. It was found brown and white eggs need the same temperature. Machine No. 1 produced 69.3 per cent of vigorous chicks to fertile eggs; machine No. 2, 69.5 per cent; machine No. 3, 64.4 per cent; and machine No. 4, 30.5 per cent. In every test machine No. 2 produced the largest, plumpest, and best chicks. The chicks in machines Nos. 1 and 3 were very similar, but those in No. 4 were poor and weak in every hatch.

The average weekly temperatures for the four experiments as recorded by the different thermometers in incubator No. 2, with which the best hatches were obtained, were as follows:

Average temperatures in machine No. 2.

Period.	Kinds of thermometers.				
	Standing.	Touching on white eggs.	Touching on brown eggs.	Hanging.	Inovo.
	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*
First week	100.9	101.5	100.9	104.7	98.0
Second week	102.1	102.6	102.4	104.9	99.8
Third week	103.0	103.7	103.4	104.3	101.2
Average	102.0	102.6	102.2	104.6	99.7

It is stated that the incubator records show that the temperatures were held practically to the desired point daily.

With the type of incubator used in these experiments it was found that "if a touching thermometer is used it should be 0.5° higher than a standing, regardless of color of eggs. If a hanging thermometer is used it should be run on an average of 2° higher than a standing, with a greater difference the first week and a less difference the third week. The Inovo should be run about 2.2° lower than a standing."

In a minor experiment in connection with one of the main experiments it was found that "a temperature with a standing thermometer of 100.5° the first week, 101.5° the second, and 102.5° the third week compares well in temperature and hatching results with a hanging thermometer temperature of 103° for three weeks."

In an experiment run in duplicate in 1911 with two of the experimental incubators and using white eggs, machine No. 1 was controlled by a standing thermometer and run at 101, 102, and 103°, respectively, for the three weeks, and machine No. 2 by the Inovo thermometer and run at 100.5° for the three weeks. The average hatching record of machine No. 1 was as follows: Eggs set, 147.5; infertile eggs, 9.5; dead germs, 8.5; dead in shell, 27.5; and chicks hatched, 102. For machine No. 2 the corresponding averages were 149, 12, 7.5, 25.5, and 104. In this experiment incubator No. 1 was kept reasonably near the desired temperatures by the standing thermometer, the average for the three weeks being 102.2°. At the same time the Inovo thermometer in this machine registered 98.3° the first week, 99.6° the second, and 101.1° the third, averaging for the whole period 99.6°. In incubator No. 2, controlled by the Inovo thermometer, the temperature registered 100.4° the first week, 100.6° the second week, and 100.6° the third week, averaging for the whole period 100.5°. The standing thermometer in this machine registered 103° the first week, 102.7° the second week, and 102.3° the third week. In this test the standing thermometer temperatures of the two machines varied only 0.5°, but one increased during the hatching period and the other decreased, yet the hatches were similar. The results of this experiment tend to show that 100.5° is not the only temperature desirable with an Inovo thermometer.

The data in connection with these experiments are tabulated and discussed in detail.

Goose raising, H. M. Lamon and A. R. Lee (*U. S. Dept. Agr., Farmers' Bul. 767 (1917), pp. 16, figs. 8*).—Information is given in reference to the appearance and adaptability of the different breeds of geese, together with details as to breeding, feeding, and marketing.

DAIRY FARMING—DAIRYING.

Report of the dairy husbandry department, O. F. Hunziker (*Indiana Sta. Rpt. 1916, pp. 29–40*).—In testing rations for milch cows three lots of 5 cows each were fed six rations for 180 days. All the rations contained ground corn and corn silage, and in addition ration 1 contained cottonseed meal and alfalfa hay, ration 2 cottonseed meal and soy-bean hay, ration 3 linseed meal and alfalfa hay, ration 4 linseed meal and soy-bean hay, ration 5 gluten feed and alfalfa hay, and ration 6 gluten feed and soy-bean hay.

It was found that "a ration used in milk production, which contains ground corn, corn silage, and a leguminous hay requires but a limited amount of protein-carrying concentrates in order that it may be properly balanced. The three protein-carrying concentrates used in this experiment affected the cost of the rations less than any other of the four feeds of which the ration was composed. When fed in connection with alfalfa hay, cottonseed meal was the most economical source of protein, gluten feed ranking second and linseed meal

standing third. . . . Alfalfa hay was 12 per cent more economical as a milk-producing roughage than soy-bean hay when both were selling at the same price per ton. This does not take into account the greater quantity of soy-bean hay refused, due to its unpalatable characteristic.

"The cost of milk was affected to the greatest degree by varying the price of corn; the hay was of next importance, the corn silage ranked third, and the protein-carrying concentrates fourth. The hay and corn exerted almost the same influence upon the cost of milk. The use of soy-bean hay caused an increase in body weight and a decrease in daily milk and butter-fat production.

"Properly balanced rations are, approximately, equally efficient in the production of milk and butter fat per unit consumption of dry matter. The nutritive ratio of a ration may be varied within reasonable limits without materially affecting the productive power of the ration."

In the experiment to determine the effect of cottonseed meal and linseed meal upon the breeding power of dairy heifers (E. S. R., 34, p. 775), 16 heifers fed in winter a ration of wheat bran, corn silage, and alfalfa hay supplemented with 3.103 lbs. of cottonseed meal daily were bred an average of 1.06 times each, the average age at time of conception being 1 year, 7 months, and 6 days. Nineteen heifers fed the same as the above lot, except that 3.055 lbs. of linseed meal replaced the cottonseed meal, were bred an average of 1.8 times each, the average age at conception being 1 year, 7 months, and 26 days.

In experiments upon the pasteurization of cream for butter making it was found that in the case of sour, gathered cream that is not neutralized pasteurization at 145° F. for 20 minutes is the most satisfactory process from the standpoint of germ-killing efficiency and quality of butter.

In studies upon the changes occurring in butter and milk fat during storage it was found that the proteins are gradually hydrolyzed into simpler compounds. During this hydrolysis, amino acids are formed as one of the decomposition products. The degree of hydrolysis depends upon the initial condition of the proteids, the quantity of hydrolizing agents present, and the temperature at which the butter is kept. The percentage of gain in proteid nitrogen not precipitated by phosphotungstic acid was 4.157 for raw cream butter, 3.465 for butter from cream pasteurized at 145° for 20 minutes, 3.161 for butter from cream pasteurized at 165° flash, and 2.99 for butter from cream pasteurized at 185° flash. Little variation was found in the constants of the fat of stored butter with the exception of the acid value, which showed a marked increase in the raw cream butter and smaller increases in butters from cream pasteurized at different temperatures.

Bacteriological analyses made of the cream and butter in connection with the pasteurization experiment show that pasteurization at 145°, holding process, "gives the greatest killing efficiency for all varieties of micro-organisms present. The flash system at 185° gives next best killing efficiency but does not give uniform results. The flash system at 165° shows lowest killing efficiency for all varieties of micro-organisms and is the most variable of the three methods."

Preliminary studies upon the cause of oily flavor in butter from cream pasteurized at 185° indicate that this condition is due to a combination of the high degree of heat in the presence of high acidity.

Notes are given on the activities of the department in the testing of pure-bred dairy cows and creamery inspection work.

Feeding and management of dairy calves and young dairy stock, W. K. BRAINERD and H. P. DAVIS (*U. S. Dept. Agr., Farmers' Bul. 777* (*1917*), *pp. 19, figs. 5*).—In addition to a detailed discussion of this subject, brief information is given on calf diseases.

Milking machines: A study of the practical operation of 108 milking machines in Jefferson County, New York, F. E. Robertson and C. W. Gilbert (*Jefferson Co. [N. Y.], Farm Bur. Bul. 7 (1916), pp. 12*).—A brief report is given of a study of the operation of 108 milking machines representing seven different makes in Jefferson County, N. Y. The study was conducted during very hot weather in July and August, 1916. In order to compare hand milking with machine milking information was also accumulated from 51 different milkers, including men, women, and boys relating to the time required to milk out 100 lbs. of milk by hand.

It was found that with the different makes of milking machines it required from 80 to 126.5 minutes to milk 100 lbs. of milk per unit, as compared to 68 minutes by hand. Under the same conditions the different units milked from 6 to 7.5 cows per hour as compared to 6.9 cows per hour by hand. These data include the customary time required to start the engine, place the teat cups on the cows, change the units from cow to cow, and care for the milk in the usual manner. The strippings after milking with a mechanical milker averaged less than 1 lb. per cow.

The most efficient combination of operators and units seemed to be where one operator used four single units or two double units, although greater speed was made with other combinations. One operator using three single units obtained 100 lbs. of milk in 28.8 minutes, while one operator using two double units obtained 100 lbs. of milk in 32.4 minutes.

It took from 15 to 20 minutes daily on the average to properly cleanse the milking machines.

Market milk contests and dairy surveys, L. H. Cooledge (*Michigan Sta. Rpt. 1916, pp. 251–255*).—Results are given of a number of market milk contests, market cream contests, and sanitary surveys of milk plants, dairy farms, and milk plant water supplies made in a number of places in the State during the year for the purpose of establishing a proper basis for educational and extension efforts in connection with milk production and marketing.

A sanitary survey of the milk plants and farms supplying milk for the city of Flint, Mich., showed an average score of 58.3 for the milk plants, none of them scoring above 75. The average score of 40 dairy farms was 59.4, only one of which scored above 75. In connection with this survey a milk contest was held in which the milk samples were taken from wagons without previous warning. Of the 18 samples examined only one scored above 90 and nine below 60. During the following March a second milk contest was held at Flint, in which 31 per cent of the samples scored above 90 and none below 60. This contest included samples prepared for the contest and samples taken from wagons without warning.

Bacteriological analyses of water made in connection with these dairy surveys showed that 37 per cent of the city water samples and 70 per cent of the samples of rural dairy water supplies examined were sewage polluted.

A plea for uniformity in municipal milk regulations, L. P. Brown (*Milk Dealer, 6 (1917), No. 4, pp. 24, 26, 28, 30–32, 34*).—In this paper, which was read before the International Association of Dairy and Milk Inspectors at Springfield, Mass., the author compares the milk regulations of 17 of the larger cities of the United States, and shows by means of tables the lack of uniformity in the requirements of the various cities for the production of sanitary milk.

Report of the committee on methods of appointment of dairy and milk inspectors and their compensation, E. Kelley (*Milk Dealer, 6 (1917), No. 4, pp. 18–20, fig. 1*).—In this report, read before the International Association of Dairy and Milk Inspectors at Springfield, Mass., tabulated data with brief com-

ments are given of information received from 31 States and 102 cities concerning methods of appointment and compensation of dairy and milk inspectors.

Reliability of the bacteriological analysis of milk, H. W. Conn (*Milk Dealer, 6 (1917), No. 4, pp. 50–56*).—In this paper, read before the International Association of Dairy and Milk Inspectors at Springfield, Mass., the author discusses the reliability and significance of bacteriological milk analysis. A summary is given of an extensive series of tests made during the last three years in a considerable number of laboratories to determine the amount of variation in the analysis of milk that may be introduced by conditions beyond control.

The results of 20,000 analyses show that by standard methods used in routine laboratories by ordinary laboratory assistants variations of from 25 to 30 per cent in the analysis of identical samples of milk may be expected to occur. Where special care is taken by experts a much closer result is obtained. However, in view of the enormous range in number of bacteria occurring in different samples of milk this amount of variation in the results of bacterial counts is considered of no real significance. "A bacteriological analysis of milk can not be relied upon to give actual numbers of bacteria, but only approximate numbers. . . .

"The bacteriological analysis of milk is not to be taken as indicating in itself either a condition of safety or a condition of danger, but only as a warning. Good, clean, fresh milk will have a low bacterial count, and a high bacterial count means dirt, age, disease, or temperature. A high bacterial count is therefore a danger signal, and justifies the health officer in putting a source of supply with a persistently high bacterial count among the class of unwholesome milk.

"Bacteriological analysis offers the only means of grading milk according to its sanitary character. A grading system applied to the milk industry is the great desideratum for the improvement of the industry in the future from the standpoint of the producer, the dealer, and the consumer."

Why cream tests vary and how to produce first-grade cream, E. O. Challis (*Union So. Africa Dept. Agr. [Pub.], 82 (1915), pp. 21, figs. 9*).—The author explains the various points connected with the successful operation of cream separators and reports the results of several series of tests with a 45-gal. separator to ascertain the cause of variations in cream tests.

In testing the effect of variations in the speed of separators, using milk testing 4.3 per cent fat and separating at a temperature of 86° F., it was found that turning the handle 60 revolutions per minute, the prescribed speed, gave cream testing 54 per cent fat and turning at 55, 50, and 45 revolutions per minute, gave creams testing 46, 31, and 26 per cent, respectively. Irregular turning produced cream testing 44 per cent fat. In separating milk testing 3.5 per cent fat at 86 to 90° when the separator handle was turned at 60 revolutions per minute, cream containing 34 per cent fat was obtained, and when turned at 74 and 40 revolutions per minute 52 and 20 per cent creams, respectively, were obtained. Turning the handle irregularly produced 27 per cent cream.

In a test in which milks of different fat contents were separated under identical conditions, the separator being turned at 60 revolutions per minute and the milk separated at 88°, milk testing 4.8 per cent fat produced 49 per cent cream, and milk testing 2.9 per cent produced 38 per cent cream.

The final experiment had to do with the effect of temperature of the milk upon the fat content of the resulting cream. Using 3.7 per cent milk and turning the separator at 60 revolutions per minute, milk separated at 90° produced 42 per cent cream, and milk separated at 80 and at 74° produced 51 and 52 per cent creams, respectively.

Notes are given on the care of cream on the farm.

Marketing creamery butter, R. C. POTTS and H. F. MEYER (*U. S. Dept. Agr. Bul. 456 (1917), pp. 37, figs. 17*).—General information is given regarding the packing, shipping, and marketing of creamery butter, based on a general survey in over 50 cities. The more complex economic phases of butter marketing are not discussed.

The authors state that "a knowledge of the various market requirements, marketing methods, and marketing facilities is essential for the successful marketing of creamery butter. Particular attention should be given to the market requirements as regards quality of butter and size and style of packages. Critical markets require a clean-flavored, firm-bodied, well-made piece of butter for which they pay the highest prices. Butter of inferior quality is discriminated against by critical buyers and usually sells at prices considerably below the better grades.

"The use of neat and attractive containers, standardized to a uniform size and style, is highly desirable both for local and foreign markets. Carelessly packed butter has not only a poor appearance but also usually brings a lower price. The branding of bulk-butter packages (tubs and cubes) with the gross, tare, net weight, and churning number greatly facilitates the handling and inspection of butter in the market. The use of consumers' packages for butter is increasing. A standardization of these, particularly the cartons, is especially desirable.

"Market grades for butter have been established by a number of wholesale produce organizations. While these conform quite closely to a uniform standard it is generally conceded that butter which will pass in some markets for a certain grade may be classed differently in another, owing to a different standard of quality which the butter inspector may use. The employment of butter inspectors and the maintenance of market inspection is at present provided in the wholesale markets by the organizations of wholesale butter distributors."

Statistics of cold-storage holdings of butter in 1914 indicate that 81 per cent of the butter stored is delivered into storage during May, June, July, and August. The deliveries out of storage are more gradual. The average length of storage is approximately 6.2 months. "The cost of financing and handling butter in storage is approximately one-fourth cent per pound per month.

"Regular, scheduled refrigerator rail service is provided for butter in the more highly developed dairy sections. Express service often is employed for shipping to near-by markets and may be used in combinations with refrigerator freight service in reaching the more distant markets. Cooperation among creameries has proved of value in obtaining and using refrigerator service where creameries are located in close proximity to each other.

"State brands for butter which creameries are permitted to use when they have complied with State requirements have been adopted by Minnesota, Iowa, and Michigan. They are intended to convey a guaranty of purity and quality in the butter which will be of mutual benefit to both the producer and the consumer. The establishment of brands is essential for effective advertising or in retaining the identity of the manufacturer of a product. Appropriate advertising and salesmanship are also two vital factors in successful market distribution. In marketing a branded product it is highly important that a sanitary and attractive package be used and that a certain standard of quality be maintained."

VETERINARY MEDICINE.

Report of the veterinary department, R. A. CRAIG (*Indiana Sta. Rpt. 1916, pp. 67, 68*).—The incubation for two weeks of filtrates obtained by passing hog-cholera blood through Pasteur-Chamberland and Berkefeld filters resulted

in a slight cloudiness and a very noticeable precipitate. Microscopic examinations of the filtrates showed an increase in the so-called granules. An increase in the albumin content of the filtrates during the incubation period was also observed. Examination of the filtrate after the removal of this albumin did not show the presence of the granules.

Five pigs which were removed from their mothers at birth and fed by hand were injected intravenously and intraperitoneally with 60 cc. of a hog-cholera blood filtrate. Three similar animals were used for controls. After four days both the inoculated and control pigs were bled and the blood examined microscopically. No difference was observed between the blood of the two sets of animals. The inoculated pigs on post-mortem examination showed slight hemorrhages in the lungs, lymphatic glands, and kidneys. The control pigs showed hemorrhagic foci in the kidneys, a condition which has been shown to be common in young pigs.

An attempt to attentuate hog-cholera blood by passage through rabbits and using a virus prepared by extracting the carcasses of injected rabbits with physiological salt solution and passing it through a Pasteur filter was unsuccessful. Six of the eight pigs inoculated with this virus died of acute hog cholera and five exposure check pigs also died.

Hog-cholera blood dried over sulphuric acid for periods varying from 10 to 15 days and subjected to heat of from 40 to 42° C. for periods of from four to seven days did not produce the disease. No immunity, however, was conferred, as the inoculated pigs died later when exposed to hog cholera. The work to determine the relative virulence of hog-cholera blood at different periods of the disease, as previously noted (E. S. R., 34, p. 783), was continued. The data are reported in tabular form.

Of 156 samples of blood tested for infectious abortion in cattle by the agglutination test, 96 yielded negative results and 60 positive reactions.

Report of the veterinary department for the biennial period, July 1, 1912, to June 30, 1914, J. I. Gibson (*Bien. Rpt. Vet. Surg. Iowa, 9 (1913–14), pp. 36*).—This report includes data relating to hog cholera control work in Dallas County, Iowa, and rules and regulations adopted by the animal-health commission of the State.

Fifteenth report of the Live Stock Sanitary Board and chief veterinary inspector of Maryland, 1914–15, L. Hickman et al. ([*Bien.*] *Rpt. Live Stock Sanit. Bd. and Chief Vet. Insp. Md., 15 (1914–15), pp. 45, figs. 7*).—This report deals with the occurrence of and control work with infectious diseases of animals in Maryland, reporting at length on the occurrence of and eradication work with foot-and-mouth disease during the recent outbreak.

Proceedings of the fifteenth annual convention of the North Dakota Veterinary Association (*Proc. N. Dak. Vet. Assoc., 15 (1916), pp. 46*).—The greater part of this report is taken up by a paper on Sterility in Cattle, by W. L. Williams (pp. 15–39).

Annual report of the veterinary service for the year 1915, W. Littlewood (*Ann. Rpt. Vet. Serv. Egypt, 1915, pp. VI+59; abs. in Trop. Vet. Bul., 4 (1916), No. 4, pp. 192–196*).—The several sections of this, the usual annual report (E. S. R., 36, p. 180), deal with contagious diseases, the work of the veterinary pathological laboratory, and the work of the school of veterinary medicine.

A Note on Spraying of Cattle with Special Dips for the Eradication of Ticks, by H. Cooper (pp. 45–48); a census of cattle, buffaloes, sheep, goats, camels, pigs, horses, mules, donkeys, etc., in Egypt during 1914 as compared with that of 1915; and the return of animals slaughtered in the principal abattoirs during the year are appended.

Directions for preparation of veterinary specimens for examination, M. Francis (*Texas Sta. Circ. 16 (1916), pp. 7, figs. 3*).—A brief descriptive account.

Studies on the blood proteins.—I, The serum globulins in bacterial infection and immunity, S. H. Hurwitz and K. F. Meyer (*Jour. Expt. Med., 24 (1916), No. 5, pp. 515–540, figs. 7*).—The results of the investigation reported are summarized as follows:

"The progress of an infection is usually associated with marked changes in the serum proteins. There may be an increase in the percentage of the total protein during some stage of the infection, and there is usually a change in the albumin-globulin ratio with an increase in the total globulins. This rise may antedate the development of any resistance by a considerable period of time. The nonprotein constituents of the blood show fluctuations with a tendency to rise as the infection progresses.

"The process of immunization is in almost all instances associated with a definite increase in the globulins of the blood, and in some cases with a complete inversion of the normal albumin-globulin ratio. This may be produced both by living and dead organisms and by bacterial endotoxins. Massive doses usually result in an upset which shows no tendency to right itself during the period of observation. A rise in the globulins has been shown to occur long before the animal develops immune bodies in any appreciable concentration; and where the globulin curve and antibody curve appear to parallel one another it can be shown by a careful analysis of both curves that there is a definite lack of correspondence at various periods of the experiment. Animals possessing a basic immunity show a more rapid rise in the globulin curve following inoculation."

No parallelism was observed between the leucocytic reaction and the globulin reaction. The globulins may be as high during periods of leucopenia as during the period of a leucocytosis. As striking an increase in the serum globulins is produced by bacterial endotoxins as is produced by living and killed bacteria. This would seem to indicate that a bacterial invasion of the organism is not absolutely essential for the globulin changes, and that the toxogenic factor in infection and immunity must play a part in the production of the changes noted.

"Inflammatory irritants injected intraperitoneally also result in a globulin increase. In this case the changes produced may best be explained by the toxogenic effect produced by the protein-split products resulting from the inflammatory condition. Intraperitoneal injections of killed bacteria give rise to a more rapid increase in the serum globulins. The rapidity of the response following intraperitoneal as compared with intravenous injections doubtless stands in intimate relationship to the neutralizing power possessed by the blood serum, and perhaps to the more extensive surface of absorption following injection by the intraperitoneal route."

Experimental observations on the pathogenesis of gall-bladder infections in typhoid, cholera, and dysentery, H. J. Nichols (*Jour. Expt. Med., 24 (1916), No. 5, pp. 497–514*).—The results of investigations with the common duct fistula method in the rabbit lend support to the theory of the production of gall-bladder lesions in typhoid by a descending infection of the bile from the liver. "More bacilli appear in the bile with increased doses, and more gall-bladder infections are obtained by increased doses. More bacilli appear in the bile after mesenteric vein injection than after ear vein injection, and more lesions result under the first condition. More bacilli appear in the bile after injection of the same dose in immunized animals than in normal animals, and more lesions also result in immunized animals."

The fate of the micro-organisms after their appearance in the bile seems to be largely determined by the antiseptic properties of the bile which are largely due to its alkalinity. It appears possible to protect the rabbit against gall-bladder infections, at least to some degree, by the previous injection of sodium bicarbonate.

Alkaline therapy is suggested in the prevention and cure of gall-bladder carriers.

A comparison of the "defibrination" and "oxalate" methods of serum preparation as applied to hemorrhagic septicemia and anthrax sera together with some analyses of buffalo and hill bull blood, R. V. NORRIS (*Agr. Research Inst. Pusa Bul. 60 (1916), pp. 15*).—The results of the investigation submitted in detailed tabular form show that the oxalate method gives a considerably increased yield of serum as compared with the defibrination method in the preparation of hemorrhagic septicemia and anthrax sera. Serum prepared by the oxalate method is also greatly superior in appearance to that obtained by defibrination and centrifugalization. In the case of buffalo blood the oxalate procedure saves considerable centrifugalizing, which is of practical importance in the preparation of large quantities of sera. With hill bull blood the corpuscles do not settle, and the blood must be centrifugalized. A series of bleedings taken at short intervals was found to increase the yield of serum progressively, the third bleeding giving the largest percentage of serum. Analyses of normal buffalo and hill bull blood indicated that the chief point of difference was the considerably larger percentage of globulins in the serum from the hill bull blood.

Anthrax or charbon, H. J. WASHBURN (*U. S. Dept. Agr., Farmers' Bul. 784 (1917), pp. 16*).—This supersedes Farmers' Bulletin 439, previously noted (E. S. R., 25, p. 381).

The diagnosis of tuberculosis by means of tuberculin with special reference to the intrapalpebral method, N. MORI (*Atti R. Ist. Incoragg. Napoli, 6. ser., 67 (1915), pp. 71–89*).—This material has been previously noted from another source (E. S. R., 36, p. 578).

Experiments on cattle plague, C. TODD and R. G. WHITE (*Cairo, Egypt: Govt., 1914, pp. IX+133, figs. 136*).—This is a report of work carried out for the commission nominated by the Council of Ministers April 13, 1912.

The several parts of the report deal with the localization, etc., of rinderpest virus in the animal body, methods of the transmission of the disease and tenacity of virus outside the body, general considerations on the nature of the causal organism, a bibliography on the subject, meteorological data, and details of the experiments. An appendix includes a brief abstract of the results obtained.

Hog cholera, M. E. TABUSSO (*Bol. Min. Fomento [Peru], 14 (1916), No. 4, pp. 5–23*).—This is a general discussion with special reference to observations of the disease in Peru. The topics considered are spread of the disease, etiology, clinical forms, diagnosis, therapy, and prophylaxis.

Tuberculosis of hogs, J. R. MOHLER and H. J. WASHBURN (*U. S. Dept. Agr., Farmers' Bul. 781 (1917), pp. 19, figs. 4*).—This is a revision of the circular previously noted (E. S. R., 27, p. 684). The topics discussed are the prevalence and economic importance of the disease, methods of infection, symptoms of tuberculosis in hogs, the tuberculin tests, lesions, and preventive measures.

Osseous cachexia and verminous cachexia of equines.—Cylicostomiasis, C. CONREUR (*Bul. Soc. Path. Exot., 9 (1916), No. 8, pp. 600–633; abs. in Trop. Vet. Bul., 4 (1916), No 4, pp. 181–184*).—This is a discussion of a disease of horses, mules, and asses occurring in Brazil, known as "cara inchada" or

"bighead," which is apparently the disease known elsewhere as osteoporosis or osteomalacia. In a number of cases examined post-mortem the author always found innumerable small worms of the genus Cylicostomum, in addition to others. Considering the disease to be of verminous origin he has applied the name cylicostomiasis.

Pseudo-epizootic encephalomyelitis of the horse, G. URBAIN (*Bul. Soc. Path. Exot., 9 (1916), No. 8, pp. 557–561; abs. in Trop. Vet. Bul., 4 (1916), No. 4, pp. 184, 185*).—This article relates to a highly fatal disease of equines in Parana, Brazil, known as "peste de cegar" (blindness disease), which is characterized by the following symptoms: Blindness; circular movements followed by a unilateral paralysis; immobility, the animal remaining for hours without moving; and a stage of excitability, depression, coma, and death. The affection is said to differ from Borna disease. The author is of the opinion that it is caused by a fungus of the genus Aspergillus found in corn.

Further investigations of the etiology and control of infectious abortion in mares, E. S. GOOD and W. V. SMITH (*Kentucky Sta. Bul. 204 (1916), pp. 337–396, pls. 8*).—This bulletin gives a brief historical review of other investigations; compares the disease of infectious abortion in the mare and cow; gives a history of the studs and cases investigated; and takes up the morphological, cultural, and physiological characteristics of *Bacillus abortivo-equinus;* agglutination and complement-fixation tests; agglutination and complement-fixation tests to determine the relationship, if any, of *B. abortivo-equinus* and other organisms belonging to subgroup II of the colon-typhoid group; inoculation experiments; production of a hyperimmune serum for infectious abortion in mares; experiments in immunizing animals with a bacterin made from *B. abortivo-equinus;* and the effect of methylene blue, hexamethylenamin, carbolic acid, and potassium permanganate on *B. abortivo-equinus.*

The authors have isolated *B. abortivo-equinus* from nine different studs of aborting mares and one stud of aborting jennets. By cultural, agglutination, and complement-fixation tests the organism has been found to be distinct from the other pathogenic organisms of subgroup II of the colon-typhoid type. The organism varies in its physiological property of splitting lactose and saccharose, as previously noted (E. S. R., 35, p. 785). A 0.1 per cent solution of potassium permanganate was found to destroy the organism in one minute, and a 1 per cent solution of carbolic acid in the same time. A 1 : 1,000 solution of methylene blue destroyed the organism in five minutes, while a saturated solution of boric acid required three hours for the destruction of the germ. It is indicated that all of these solutions, in the strengths mentioned, can be used as douches and not injure the mare.

Subcutaneous injections of *B. abortivo-equinus* produced abortions in guinea pigs and rabbits, and an intravenous injection of this organism produced abortion in the hog and sheep. The feeding of large amounts of the germ to a pregnant sow, however, produced no injury. The feeding of the organism to pregnant ewes did not produce abortion. Small doses injected intravenously into hogs resulted only in lassitude, while a large dose given intravenously and repeated produced death. The organism could be recovered from the internal organs of the animal. The intravenous injection of 1 cc. of a physiological salt suspension of *B. abortivo-equinus* into a pregnant mare produced abortion in 12 days in one case, and the injection of 2 cc. of a similar suspension into another pregnant mare produced abortion in 10 days.

A suspension of the organism in sterile water mixed with ship stuff and fed to a pregnant mare produced a persistent diarrhea which would not yield to medical treatment and resulted in the death of the animal 20 days after receiving the dose. The organism was recovered from the heart blood of the mare

and the liver of the fetus, thus "demonstrating to our satisfaction that the organism had passed through the intestinal walls to the blood stream of the mare and fetus, and would have produced abortion had the mare lived."

A bacterin prepared by suspending the organism which had been grown on plain agar in physiological salt solution and heated to 60° C. for two hours protected rabbits against 10 times the lethal dose of the organism. The subcutaneous injection of rather large doses of the bacterin in pregnant mares produced no bad effects other than an occasional abscess at the site of inoculation. The animals so treated delivered live healthy colts. The injection of increasing doses of bacterin followed later by the subcutaneous injection of increasing doses of the live organism caused a pregnant mare to deliver a live, although weak, colt which soon developed into a strong animal. The drastic treatment had a depressing effect on the mare, but she later recovered and four months afterwards was in excellent condition.

The results obtained with the hyperimmune serum have been previously noted (E. S. R., 35, p. 80).

It is indicated that, "in the light of our present investigations, a bacterin made of the *B. abortivo-equinus* injected subcutaneously will, if given to a pregnant mare in proper and increasing doses, do no harm and will, in all probability, immunize her against the disease of infectious abortion if the bacterin be administered before the disease is contracted in a natural manner. In the production of this bacterin we grow the *B. abortivo-equinus* on agar slants. The culture is then washed three times with normal salt solution in a centrifuge."

See also previous notes (E. S. R., 29, p. 779; 35, p. 885).

The avenue and development of tissue-infection in intestinal trichomoniasis, P. B. HADLEY (*Rhode Island Sta. Bul. 168 (1916), pp. 3–64, pls. 11, figs. 2*).—In continuation of the studies previously noted (E. S. R., 36, p. 483), the author reports upon the manner in which the flagellates responsible for intestinal trichomoniasis penetrate the cecal epithelium and enter the subepithelial tissues, there to produce characteristic lesions, and describes the course of the infective process.

"As a result of a more or less fluid condition of the cecal content the flagellates multiply in vast numbers by autogamous reproduction and finally migrate into the crypts of Lieberkühn, where they tend to gather at the terminal branches and produce a marked bulging of the fundi.

"Either through pressure or natural invasive power, or both, the free motile flagellates (trophozoites) penetrate the goblet cells, froce out the nucleus, or push it to one side, break through the base of the cell, subsequently through the basement membrane, and enter the connective tissue of the mucosa. A large number of flagellates may penetrate the same rift in the epithelial wall and subsequently become disseminated.

"With the further passage of flagellates through the epithelial wall they tend at first so to congregate as to separate the epithelial wall of the fundus from the basement membrane and from the core of the villus. The first mechanical effect upon the epithelial cells of the fundus is the production of a ragged, fringed appearance at the basement end.

"Either as a result of the mechanical damage brought about by the earliest of the invading flagellates or due to the effect of toxic metabolic products, the epithelial cells at the fundus of the crypts become further disorganized, permit other flagellates to pass, probably through intercellular rifts, and finally degenerate, leaving at the site of the fundus only free nuclei, cellular débris, and flagellates. Sometimes the epithelium of the fundus is pushed downward through the crypt-space without becoming fully disorganized.

"Through the subsequent migration of round cells and endothelial or other phagocytic cells into this region, the area (the crypt-space) becomes consolidated. At the same time many of the flagellates are surrounded by endothelial cells, while others proceed to invade further the core of the villus and the muscularis mucosæ. The terminal portions of the epithelium usually remain intact at this stage.

"At this point the motile forms of the flagellates for the most part disappear, and further multiplication in the tissues is continued by autogamous reproduction. At the beginning of this stage of development most of the parasites lose both the membrane and flagella, together with other organelles which characterize the trophozoite, and appear as the round or oval bodies, staining pink with eosin, which are regarded by Smith as amebas (*Amœba meleagridis*).

"With the continued invasion of other crypts, followed by similar consolidations, the deep-lying cecal epithelium becomes to a large exent destroyed, the entire mass of cecal tissue becomes parasitized, fusions with adjacent structures may occur, and secondary bacterial infections intervene. A secondary flagellate invasion of the ceca may occur through the outer serous covering as a result of contact-infection from the liver.

"With the further progress of the infection the parasites disseminate through the reticular tissues of the core of the villi and produce a sort of 'reverse infection,' attacking from the rear the epithelium overlying the terminal portions of the villi. With the gathering of parasites between the wall and the basement membrane the epithelium is first straightened and finally forced off. This is the culmination in the process leading to a more or less complete destruction of the cecal epithelium and a liberation of some of the parasites into the cecal canal.

"In explanation of the circumstances leading to the active invasion of the crypts, the data at present in hand make it appear probable that an earlier diarrheal condition present in the lower intestine and ceca is mainly responsible for the great multiplication of the flagellates (autogamy) in the cecal canal and for the subsequent invasion of the crypts. It seems much less probable that the flagellates in themselves can be regarded as the cause of the initial diarrheal state. . . .

"True amebas, chiefly *A. intestinalis*, are frequently present in the ceca, sometimes in numbers, but only in exceptional cases can it be concluded that they are of pathogenic significance in the production of cecal lesions. Aside from those cases in which it is identical with the schizont stage of *Eimeria avium*, *A. meleagridis* must be regarded as the late trophozoite (rounded) stage of the intestinal flagellate, Trichomonas."

Meningo-encephalomyelitis of fowls (? spirillosis), G. URBAIN (*Bul. Soc. Path. Exot., 9 (1916), No. 8, pp. 561–563; abs. in Trop. Vet. Bul., 4 (1916), No. 4, p. 185*).—This article relates to a disease which affects a few adult fowls in most poultry runs in the State of Parana, Brazil, where it is known locally as "ar."

Fowl plague in ducks, L. COMINOTTI (*Clin. Vet.* [*Milan*], *Rass. Pol. Sanit. e Ig., 39 (1916), No. 5. pp. 129–135, figs. 2; abs. in Trop. Vet. Bul., 4 (1916), No. 4, p. 176*).—This reports upon a study of an outbreak of fowl pest or plague among ducks on the lake of the Public Gardens of Milan in which 50 per cent of the birds became affected. The paper includes a review of the literature. The studies led to the following conclusions:

"Fowl plague may attack wild ducks placed in the same conditions as domesticated birds. The clinical form in which the disease manifests itself in these animals is the nervous form. The morbid anatomy of the disease shows nothing characteristic. The virus can not be found in the blood or in

the internal organs, even when quantities exceeding those employed in working with the disease in geese are used. It is found, however, in the central nervous system.

"The transmission of the infection to fowls is possible by means of subcutaneous injection of emulsions of the cerebral substance of infected ducks. On the contrary it is not possible to transmit it to the domesticated duck however large a dose of virus is employed, either by ingestion, intravenous inoculation, instillation on to the conjunctiva, or even by intracerebral inoculation."

RURAL ENGINEERING.

Hydraulic flow reviewed, A. A. Barnes (*New York: Spon & Chamberlain, 1916, pp. XI+158, pls. 12, figs. 15*).—This is a book of reference to standard experiments on the flow of water in pipes, channels, notches, weirs, and circular orifices, together with new formulas relating thereto derived from the author's experiments.

Part 1 deals with the experimental determination of the coefficients in the logarithmic formula for the flow of water in various kinds of pipes and channels. Part 2 deals with the measurement of water by means of triangular notches, weirs, and circular orifices, and with the abolition of the varying coefficient.

From his experiments the author draws the conclusion that flowing water always obeys one fundamental law. "As distinct from the various types of formulas which at present exist for representing isolated sets of results these new equations form one family, the individual members are all descended from the fundamental formula: $v=K\ m^a\ H\beta$. Further, this equation is directly related to the formula for all classes of pipes and channels in which the introduction of the length in the direction of flow merely causes the formula to be written: $v=K\ m^a\ i\beta$, in which $i=\frac{H}{L}$."

A bibliography and working tables and diagrams are included.

A striking feature of this book is that no recognition is given certain recent American works bearing on the subject, especially those from the U. S. Reclamation Service and the U. S. Department of Agriculture.

Hydro-electric power.—I, Hydraulic development and equipment, L. Lyndon (*New York: McGraw-Hill Book Co., 1916, vol. 1, pp. VII+499, pl. 1, figs. 234*).—It is the author's purpose in this book "to produce a work for the guidance of engineers in the practical design of hydroelectric plants, which would have the characteristics of accuracy, clearness, and completeness. Scientific discussions of various hypotheses and theories have been omitted except in cases where their incorporation in the text has been essential to the understanding of the subjects treated. . . . A number of new and original formulas appear for the first time here. Among these may be mentioned the exact formulas for solid dams and for the magnitude and location of the resultants of forces acting on dams."

The successive chapters are as follows: General conditions, flow in streams, weirs and orifices, power variation and storage, artificial waterways, pipe lines and penstocks, dams, movable crests for dams, headworks, water wheels, and speed regulation of water wheels and abnormal penstock pressures. Mathematical tables for practical use are appended.

Convenient form of hook gage, R. B. Sleight (*Engin. News, 77 (1917), No. 4, pp. 155, 156, figs. 2*).—This article describes and illustrates a convenient hook gage developed by the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture and used by its Irrigation Investigations Division.

Profile surveys in the Colorado River basin in Wyoming, Utah, Colorado, and New Mexico (*U. S. Geol. Survey, Water-Supply Paper 396* (*1917*), *pp. 6, pls. 43*).—This report, prepared under the direction of W. H. Herron, contains a plan and profile of Green River above Fontenelle, Wyo.; Green River from the Colorado state line to Horseshoe Bend, Utah; Green, Duchesne, Uinta, and White rivers in the vicinity of Ouray, Utah; Green River from mouth to Gunnison Butte, Utah; Grand River from Green River to Castle Creek, Utah; Grand River from Grand Junction, Colo., to Castle Creek, Utah; Grand River from Kremmling to Glenwood Springs, Colo.; Gunnison River from Cimarron Creek to Gunnison, Colo.; and Gila River in the vicinity of Cliff and Redrock, N. Mex.

Irrigation in Florida, F. W. Stanley (*U. S. Dept. Agr. Bul. 462* (*1917*), *pp. 62, pls. 6, figs. 10*).—This bulletin deals with the history of irrigation in Florida, and states that in 1915, 25,500 acres of truck crops and citrus groves were irrigated in Florida.

The main conditions making irrigation necessary in Florida are said to be the uneven distribution of the rainfall and the character of the soils. Soil moisture determinations in citrus groves and trucking sections showed that after the moisture content has fallen below 3 per cent the available supply is exhausted. "It is apparent that cultivation in the open spaces has had a marked effect upon the soil moisture." However it is shown "that both cultivated and noncultivated groves have depleted their available moisture supply from the soil, which evidently can be supplied only by rain or irrigation. . . . It appears that it would pay to cultivate the groves during the dry weather if all possible moisture is to be conserved. . . .

"Practically every part of the State is well supplied with water for irrigation purposes in the form of lakes, streams, or wells. The rivers are little used as an irrigation supply, either by means of diversion ditches or through the use of pumping plants, but the lakes and wells are used extensively both for irrigation purposes and for domestic supply."

The important types of irrigation practiced in Florida are described as (1) subirrigation, (2) overhead spray, (3) grove irrigation, which includes many different systems, and (4) furrow irrigation, applicable both to truck crops and to citrus groves. It is noted "that where there are uniform conditions of soil, water supply, and cropping, similar methods have been followed. This is true especially of the sections where flowing wells have been obtained. . . . What appears to be most needed to encourage the construction and operation of irrigation plants in Florida is a knowledge of cheaper installation for the higher and sandier groves, with cheap and efficient methods of distribution. Such methods are needed in many of the truck gardens and in many of the groves that lie on the lower elevations."

Tests of soil moisture content made to determine the best heads of water and length of time to be allowed for furrow irrigation are also reported. Tests in a grove in very dry sandy soil showed the rapid downward trend of the water when applied by the flood method. It is noted "that practically no water was lost by percolation or seepage below the sixth foot until more than an hour after the water had been turned off; after that time there was some loss. Water was run down a broad furrow at the rate of about 75 gal. per minute for 30 minutes." It is also shown "that water will disappear rapidly below the sixth foot if run too long. The lateral distribution is very slight, hardly a foot on either side from the edge of the furrow." When water was run only 15 minutes there was no waste of water below the third foot. Tests made with different heads showed that the distance water will run down furrows is dependent on the head provided there is some grade to the furrows. "Experi-

ments in a grove at Orlando showed that heads of 25 gal. per minute were adequate for ideal furrow-irrigation methods."

Experiments with low-pressure pipe systems are also described and some important points in the design and equipment of an irrigation plant are discussed.

Investigations in cost and methods of clearing land, M. J. THOMPSON (*Minnesota Sta. Bul. 163 (1916), pp. 31, figs. 26*).—Investigations on the methods and cost of clearing 15 acres of cut-over timberland at the Northeast Demonstration Farm and Experiment Station are reported.

The land averaged more than 200 stumps to the acre, these having a diameter of about 12 in. at the base and 10 in. at the cut-off. Sixty per cent of the timber was green. The soil is a somewhat stony clay loam with a clay subsoil, generally reddish, but in some places bluish gray. The timber was about 57 per cent balsam, 16 per cent birch, 13 per cent pine, 6 per cent cedar, 3 per cent tamarack, 1 per cent spruce, 1 per cent balm of Gilead, and 3 per cent miscellaneous. The lower grades of dynamite were used on all kinds of stumps except green birch, for which 60 per cent was found most efficient. The land was divided into three tracts of 5 acres each. On tract 1 the clearing was forced with dynamite. On tract 2 the stumps were first split with small charges of dynamite and then pulled with a machine. Tract 3, after being brushed out, was seeded to clover and timothy for pasturage, and clearing with dynamite was postponed 5 years, until 1918. The following conclusions from progress results were drawn:

"Cost and method are determined largely by the character of the soil and the kind of vegetation. The returns in forest products, cordwood, pole wood, fence posts, and saw logs cover the cost of brushing and other clearing work up to the stumping stage. The cost per stump for blasting and pulling on tract 2 was almost identical with the cost of explosives alone on tract 1. The cost of clearing was much less on tract 1, since much less labor was required in piling and burning the stumps.

"The cost per stump for removal was least for the man-power machine, slightly greater for the horse-power machine, and greatest for dynamite (this was for green timber and did not include the cost of piling, which makes the use of dynamite the cheapest method by a good margin). Some relation may apparently be established between the size of the stump and the size of the charge required to remove it.

"The man-power puller has a limited field where the conditions correspond to those at the Northeast Station. It works to best advantage on the small new farm where the farmer has very limited means. . . . It is evident that under conditions existing on the average farm in the region of the station dynamite is usually to be preferred to the stump puller, either alone or in combination.

"The plan of clearing being followed on tract 3 will not only be carried out at a lower cost but is actually giving a larger net return in pasturage the first year than has been realized from the first crops from land on which the clearing has been forced. . . .

"Following the removal of stumps from cut-over timberlands, on account of the shallow covering of vegetable matter, care should be taken to plow shallow the first time and to take immediate steps to increase the humus by seeding the land to clover and grasses, using barley or oats for a nurse crop."

Public road mileage and revenues in the Southern States, 1914 (*U. S. Dept. Agr. Bul. 387 (1917), pp. 52+LXXI, fig. 1*).—This bulletin is a compilation which shows mileage of improved and unimproved roads, sources and amounts of road revenues, and bonds issued and outstanding, and presents a

description of the systems of road administration, fiscal management, and other factors affecting road improvement in the States of Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

The total revenues applied to roads and bridges in the Southern States in 1914 amounted to $52,516,559.73, including state appropriations, amounts derived from local taxation, and expenditures from bond issues, both State and local. The total county and district road and bridge bonds outstanding on January 1, 1915, amounted to $64,639,060.83. The total road mileage as of January 1, 1915, was 814,565, of which 73,594.78 miles, or 9.03 per cent, were surfaced. This does not include streets in incorporated cities and towns. Of the surfaced roads 29,287.88 miles were sand clay, 21,377.37 miles were macadam, 17,440.02 miles were gravel, 1,994.36 miles were bituminous macadam, 1,924.68 miles were shell, 379.81 miles were brick, 273.24 miles were concrete, and 917.42 miles were surfaced with other materials.

Earth, sand-clay, and gravel roads, C. H. Moorefield (*U. S. Dept. Agr. Bul. 463 (1917), pp. 68, pls. 5, figs. 24*).—This bulletin gives general information on the location and design of roads and deals with the construction, maintenance, and cost of earth, sand-clay, and gravel roads.

With reference to grades, "tests made by the Office of Public Roads and Rural Engineering indicate that, on a level road average farm horses untrained to the road can exert a steady pull for several consecutive hours equivalent to from 0.08 to 0.1 of their own weight without undue fatigue, and that by resting at intervals of from 500 to 600 ft. they can exert a pull equivalent to about 0.25 of their weight, provided the foothold is good. The tests also indicate that with a well-constructed wagon the pull required to move a gross load of 1 ton over a level road varies about as follows: Loose-sand road, 315 lbs.; average dry earth road (varies greatly), 150; firm earth or sand-clay road, 105; average gravel road, 80; and first-class gravel or macadam road, 55. . . .

"For economy the maximum grade for any particular road should be fixed with due regard for the type of surface to be employed. Where the road is through deep sand, a horse of [1,255 lbs. weight], by extraordinary exertion, could pull his allowable continuous load of 760 lbs. for level grades up a short grade of about 10 per cent, while in the case of a firm earth or sand-clay road the allowable continuous load for level grades is 2,285 lbs., and the steepest grade up which the horse could possibly pull this load is about 5 per cent. For average gravel roads the corresponding comparison would show a maximum grade of about 4 per cent. . . . According to the best current practice, where the road is or is expected to become of sufficient importance to warrant a highly improved surface, the maximum grade usually is fixed with reference to this feature about as follows: Coastal plain and prairie regions, 2 to 3 per cent; average rolling country, 4 to 6; and hilly or mountainous regions, 6 to 8."

In dealing with gravel roads the results of a number of tests made on gravel obtained from various parts of the country with reference to its suitability for use in road surfaces are given. "In general, it has been found that satisfactory gravel will conform to the following limits as to percentages of fine and coarse material: (1) Material retained on a $\frac{1}{4}$-in. sieve 55 to 75 per cent, (2) material retained on a $\frac{3}{4}$-in. sieve not less than 15 per cent, (3) material (clay) passing a 200-mesh sieve for the surface course 8 to 15 per cent, and (4) material (clay) passing a 200-mesh sieve for the foundation course 10 to 15 per cent. The sand content should be at least twice as great as the clay content,

and the sand and clay, when thoroughly mixed, should be sufficient to fill the voids between the larger gravel particles."

An appendix on typical specifications is included.

Earth roads and the oiling of roads, H. A. LaRue (*Univ. Missouri Bul., 17 (1916), No. 16, pp. 29, figs. 10*).—This bulletin deals with the construction, grading, and maintenance of earth roads, and with the history and general considerations as to oiling roads and selection of road oils, and with methods of oiling earth, macadam, and gravel roads. The principal items in the proper oiling of earth roads are summarized as the "proper drainage of both surface and subsurface, heavy grading done at least one season in advance of oiling, proper shaping of the roadway to form a good crown and gutters, maintenance of the surface with the road drag for some time previous to oiling to insure compact and smooth roadway, careful removal of dust before oiling (this is of the utmost importance), proper method of applying oil (includes thorough mixing of oil in earth), use of the right kind of oil (quality of oil can be determined only by proper tests), and proper maintenance after oiling and renewed oiling as needed."

Width of wagon tires recommended for loads of varying magnitudes on earth and gravel roads, E. B. McCormick (*U. S. Dept. Agr., Office Sec. Circ. 72 (1917), pp. 6, figs. 6*).—"The recommendations in this circular relating to widths of wagon tires suitable for use on country roads of earth and gravel, as well as upon those of a more improved type, are based upon two factors, (1) the unit weight for width of tire commonly used for road rollers, and (2) the results secured from a large series of traction tests conducted by the Office of Public Roads and Rural Engineering, extending over several years and made in widely scattered localities throughout the United States. . . .

"From the curves shown the following conclusions may be drawn for well-constructed dry earth roads: With a gross load of 5,000 lbs. the unit draft decreases with the width of tire up to and including the 5-in. width. The unit draft decreases directly as the weight per inch width of tire decreases, until a weight of 250 lbs. per inch of tire is reached. . . . The fact that the draft for a 6-in. tire is larger than that for a 5-in., in all cases shown, merely indicates that there is no advantage in increasing the width of tire beyond a certain point, and there may be a disadvantage in so doing. It is not advisable to exceed in any vehicle a unit weight per inch of width of tire in excess of that possessed by a standard road roller.

"While there has been in the past, and to a certain extent still is to-day, wide variation in sizes and types of wagons marketed by the different manufacturers, it is believed that five sizes of wagons will be sufficient to meet all the needs of farming operations and all general work except the heaviest trucking and certain specialized hauling, which is likely to be confined to city pavements. These five sizes are (1) a one-horse wagon having a gross load capacity of 2,000 lbs. and a skein from $2\frac{1}{4}$ to $2\frac{3}{8}$ in., (2) light two-horse wagon with a skein approximately $2\frac{1}{2}$ in. and a gross carrying capacity of 3,500 lbs., (3) medium two-horse wagon with a skein not exceeding 3 in. and designed for a gross load of 4,500 lbs., (4) standard two-horse wagon with a skein of $3\frac{1}{4}$ in. and a gross carrying capacity of 6,800 lbs., and (5) heavy two-horse wagon having a skein of $3\frac{1}{2}$ in. and gross load capacity of 7,500 lbs." The widths of tire recommended for these five sizes of wagon are respectively 2, $2\frac{1}{2}$, 3, 4, and 5 in.

"As there is considerable difference in the practice of manufacturers regarding the size of skein used on the various types of wagons, it is recommended that wagons be not designated by size of skein but according to the gross load

capacity and that a name be adopted for each of the sizes. It is further recommended that the gross carrying capacity of the wagon be shown by stencil or plate on the back of the rear axle."

Tests of large reinforced concrete slabs, A. T. GOLDBECK and E. B. SMITH (*Proc. Amer. Concrete Inst., 12 (1916), pp. 324–334, figs. 7*).—Tests of three reinforced concrete slabs to determine the distribution of stresses and the effective widths are reported. Each of the three slabs was made of 1:2:4 gravel concrete, machine mixed, and was reinforced with 0.75 per cent of plain square steel bars with no transverse reinforcing. The slabs were 32 ft. wide, of 16 ft. clear span, with a 10 in. bearing width on each support. Tests were begun at the age of about 28 days and were continued periodically until the time of breaking. One slab was broken at the age of about six months; a second at about five months; and a third at three months. The deformation values for each slab and for the different load values are shown graphically. Each curve is plotted from the deformation values measured perpendicular to the supports and spaced along the center line parallel to the supports.

The general shape of the curves for all loads is the same for the concrete and the steel. One of the important facts brought out is that the time element is a very large and important factor in determining stress values and their distribution from the fiber deformations. "Concrete exhibits a marked flow or molecular adjustment under working stresses extending over time periods of several weeks."

From a series of experiments on the flow of concrete it is pointed out that "when concrete is subjected to a compressive fiber stress of 700 lbs. the immediate fiber deformation is only about 50 per cent of what it will be if the stress is maintained for three weeks. Within 24 hours after the application of the load the deformation has increased an additional 20 per cent; during the first hour the deformation may show a change of 5 per cent or more. Furthermore the recovery of the deformations, after the removal of the load, is slow and not complete.

"All tests for stress and deformation values in concrete must be conducted only with a full realization of the importance of the time factor. The immediate fiber deformation is the value which should be used, and not the value obtained after a long-time suspension of the load, nor that which contains the effect of several applications and removals of loads."

From the data on effective width obtained when considering thickness and load and its distribution it is noted that "there is a general tendency for the effective width to increase slightly with the increase of load. Also the effective width seems to vary inversely as the thickness of the slab. In the light of the information available at the present time we should be safe in using a value for the effective width equal to 0.7 of the span. This will probably result in the design of a somewhat thinner slab than is usual; but the fiber stress values and the large ultimate breaking loads of these slabs are an indication of the safety of such designs."

A milk house for Texas, L. RHODES (*Texas Sta. Circ. 15 (1916), pp. 3–7, figs. 4*).—This circular describes and illustrates with plans a milk house to be built near the dairy barn and sufficient in size to provide room for handling the milk from 20 or more cows.

Principles of poultry house construction, M. C. KILPATRICK (*Agr. Col. Ext. Bul. [Ohio State Univ.], 12 (1916–17), No. 2, pp. 32, figs. 37*).—It is the purpose of this bulletin to discuss briefly the fundamental principles which should be considered in the housing of poultry, and to present a number of plans of poultry houses for various purposes which are well adapted to Ohio conditions.

RURAL ECONOMICS.

Agriculture after the war, A. D. HALL (*London: John Murray, 1916, pp. VIII+137, figs. 3*).—The author discusses the present status of agriculture in England and Wales.

He concludes that "in the interests of the nation as a whole it is necessary to grow at home a larger proportion of the food we consume: (1) As a national insurance in time of war; (2) to develop our internal resources and reduce our foreign indebtedness, a matter which becomes of greatest moment in war time; (3) to increase the agricultural population as a specially valuable element in the community. . . .

"Five methods are outlined for obtaining a more intensive cultivation of the soil and providing employment upon the land. These are the establishment of large industrialized farms working on a considerable area with all the economic advantages of organization and scientific management, the establishment of colonies of small holders linked together by a cooperative organization, the intensification of the methods of existing occupiers, the reclamation and settlement of waste and undeveloped areas, the establishment of certain subsidiary agricultural industries."

Farming in the blue grass region, J. H. ARNOLD and F. MONTGOMERY (*U. S. Dept. Agr. Bul. 482 (1917), pp. 29, figs. 13*).—It was found that specialized farms, those of the tobacco, stock, or dairy type, moderately diversified, are the most efficient in this region and that the general mixed farms, more highly diversified, are the least efficient. While diversity has a vital relation to the profits in this region here as elsewhere, it appears that in the blue grass region the specialized farms have found in moderate diversity the right degree for maximum profit. "Only 34 per cent of the farms of this type could be counted as distinctly successful, while the stock-with-tobacco type had about 58 per cent successful. The dairy type, of which there were only 10, showed 70 per cent successful, with a higher average labor income and higher efficiency than any other type. Of the other three types, about 50 per cent of the farms were successful.

"The general mixed type is evidently organized on the wrong basis to be profitable. It has about the same proportion of its receipts from tobacco as the stock-with-tobacco type, but the percentage area in tobacco is very much smaller, only about 4.4 per cent, while the stock-with-tobacco type has an average of about 8 per cent of its area in tobacco. With the exception of tobacco, there seems to have been a failure to dispose of the crops raised, either by marketing them profitably or by utilizing them to advantage through live stock. Many with large farms and large capital seem to have been satisfied with bare interest on their investment, which was adequate for a comfortable living. These men made no effort to make the farm a business success. The tobacco area and much of the area of other crops on such farms was in most cases cultivated by cropper labor, which relieves the owner of much responsibility. . . .

"The farmer who can command but a small area of land should, in order to make his farm most profitable, specialize in tobacco or, where market conditions permit, in dairying. On farms of from 260 to 360 acres in size the best results can be obtained by organizing on the basis of the stock-with-tobacco type, which emphasizes live stock but cultivates an area in tobacco large enough to utilize labor resources to advantage and to secure the advantage of diversity."

Agriculture in the Imperial Valley, W. E. PACKARD (*California* [*Sta.*] *Circ. 159 (1917), pp. 70, figs. 20*).—This circular was prepared to give both new and old settlers in southern California information as to the best methods to be followed in farming there. The author describes the soil characteristics, cli-

matic conditions, water supply, irrigation, and the adaptability of a large number of crops to this region, indicating the best methods for growing, the usual yields obtained, market ability, and the most usual insect pests and diseases found. Soil analyses are included.

Facts about Georgia, compiled by L. N. GELDERT (*Atlanta, Ga.: Ga. Chamber Com., 1916, pp. 277, figs. 185*).—In this volume are discussed the resources of the State, its agriculture, manufactories, mining, and forestry.

The cost of living on Minnesota farms, 1905–1914, F. W. PECK (*Minnesota Sta. Bul. 162 (1916), pp. 3–31, figs. 10*).—The farms from which this data were gathered are those previously mentioned (E. S. R., 32, p. 688).

The total average cost of living (food, labor, equipment, fuel, and rent) was $816.63 per family, or $162.12 per person. Of the total cost, cash groceries constituted 24 per cent, farm produce 22.1 per cent, labor 28.7 per cent, equipment 5 per cent, fuel 7 per cent, and rent 13.2 per cent. The actual cash spent annually per person for farm living was $54.08, or 32.6 per cent of the total cost. Of this amount 72 per cent was for the purchase of food and the rest for fuel and labor. Of the total value of food 52 per cent was spent for groceries, 38.7 per cent representing animal products from the farm, and 9.3 per cent vegetables grown on the farm. Details are given for the different areas and for the different items of expense.

Labor requirements of live stock, A. BOSS, F. W. PECK, and T. P. COOPER (*Minnesota Sta. Bul. 161 (1916), pp. 3–43, figs. 8*).—The records upon which this bulletin is based were obtained from the same sources as those mentioned above (E. S. R., 32, p. 688). The authors have summarized their findings as follows:

Total hours required annually per head of live stock.

Kind of stock.	Northfield.		Marshall.		Halstad.		1,920-acre farm.		Average, all farms.	
	Man.	Horse.	Man.	Horse.	Man.	Horse.	Man.	Horse.	Man.	Horse
	Hours.	*Hours*	*Hours.*	*Hours.*	*Hours.*	*Hours.*	*Hours.*	*Hours.*	*Hours.*	*Hours.*
Horses	78.8	3.6	72.2	9.9	97.4	11.8	91.5	13.7	83.7	9.6
Cows	143.6	39.6	128.0	27.7	158.2	22.4	228.7	25.8	148.0	31.8
Miscellaneous cattle	17.3	....	7.0	....	13.5	....	12.8	....	11.1	....
Hogs	12.5	2.6	9.0	2.4	27.6	4.1	24.8	1.3	12.1	2.6
Sheep	3.3	.4	2.3	.6	5.0	.7	....	....	2.9	.6
Fowls (100)	124.0	5.5	145.0	16.0	141.0	8.6	265.0	....	141.2	9.6

Details are also given showing the distribution of labor requirements by months not only for live stock but also for crops.

Farmers' elevators in Minnesota, 1914–15, E. D. DURAND and J. P. JENSEN (*Minnesota Sta. Bul. 164 (1916), pp. 43, figs. 5*).—This report indicates that on January 1, 1916, there were 296 cooperative elevators in the State, which constituted about one-fifth of the total number of elevators and local mills buying grain from farmers. The bulletin points out their geographic distribution, extent of business transacted, membership, capital stock, receipts, expenses, profits, and commodities handled other than grain.

The returns indicated that the cooperative elevators received two-fifths of the grain handled by all elevators in the State, and that the operating expenses were 2.6 per cent of the gross receipts, and the profits 2.7 per cent. Of the commodities handled by elevators, 112 reported the handling of coal, 88 feed, 71 flour, 51 twine, 30 salt, 17 seed, and 13 machinery. A small number of others reported the handling of wood, lumber, tile, cement, fencing, and oil.

A list of the farmers' elevators in Minnesota is included.

[Mutual insurance companies in Illinois] (*Ann. Ins. Rpt., Ins. Supt. Ill., 48 (1916), pt. 1, pp. 86–103*).—These pages contain data regarding the status and transactions of the local mutual fire, cyclone, tornado, and wind-insurance companies during the year 1915.

Information for prospective settlers in Alaska, C. C. GEORGESON (*Alaska Stas. Circ. 1 (rev., 1917), pp. 30, pls. 5*).—This circular continues the information previously noted (E. S. R., 35, p. 295) regarding agriculture in Alaska, and adds data regarding the new homestead laws and the regulations issued by the Secretary of Agriculture for the protection of deer, moose, caribou, sheep, and mountain goats.

Public range lands—a new policy needed, R. ADAMS (*Amer. Jour. Sociol., 22 (1916), No. 3, pp. 324–351*).—The author discusses the results of the present policy of range land management and suggests changes which are deemed necessary to bring about better social and economic conditions. The discussion relates primarily to conditions in Nevada.

[Agriculture in Canada] (*Canada Yearbook, 1915, pp. 137–228, pls. 2*).—Statistical data are given for Canada regarding the climate, meteorology, average and total yield and value of the principal crops, number of live stock, stocks of wheat, prices, and freight rates, and the production of principal crops and forest products, and the number of live stock of the principal countries of the world.

Information regarding agriculture in Pinar del Rio, Cuba, A. FONTANA (*Informe General sobre las Condiciones Economico-agricolas Actuales de la Zona de la Costa Norte de la Provincia de Pinar del Rio, desde Guanajay a Guane. Habana: Sec. Agr., 1916, pp. 63, pls. 5*).—In this report are discussed the topography, climate, distribution of cultivated plants and their production, and economic conditions affecting agricultural development in this localty.

Report and tables relating to Irish agricultural laborers (*Dept. Agr. and Tech. Instr. Ireland, Agr. Statis. 1915, pp. 20*).—This report continues the information previously noted (E. S. R., 34, p. 289).

[Agriculture in Denmark], W. J. HARVEY and C. REPPIEN (In *Denmark and the Danes. London: T. Fisher Unwin, Ltd., 1915, pp. 103–116, pl. 1*).—In these pages are discussed the system of land tenure, typical Danish farms, the cooperative dairy, methods of production and distribution of raw milk, and the application of scientific methods to the farming in Denmark.

[Agricultural statistics of Spain] (*An. Estad. España, 2 (1915), pp. 64–111*).—In these pages are given, by provinces, the area, value, and production of the principal crops, together with the number of live stock.

[Agricultural statistics of Spain] (*An. Estad. España, 2 (1915), pp. 64–*
E. A. NOBBS and F. EYLES (*Rhodesia Agr. Jour., 13 (1916), No. 6, pp. 784–799, pl. 1*).—In these pages are given, by Provinces, the total land area, the cultivated area, and the area in the principal crops grown by Europeans, with comparative data for earlier years.

Australia for farmers (*Melbourne: Dept. External Affairs, 1915, pp. 163, pl. 1, figs. 176*).—In this volume there have been discussed in a popular manner the physical features, climatic conditions, crops grown, methods of havesting and marketing, and live stock production. It also contains information regarding the assistance which is given to agricultural settlers.

AGRICULTURAL EDUCATION.

The agricultural college, F. A. WAUGH (*New York: Orange Judd Co., 1916, pp. XIII+260*).—This is a discussion, from the point of view of the teacher, of the agricultural college—its purposes and ideals, organization, physical and

financial problems, organization of instruction, specialization in agriculture, courses of study (materials and arrangement, methods of teaching, extension teaching), the experiment station, and special problems and methods (farm experience, field camps, field excursions and field laboratory work, judging work, and the summer vacation).

In summarizing, the author holds that the two main purposes and ideals of agricultural schools and colleges are to give technical training, primarily, and personal human culture. There are two principal methods of providing the technical training, the first offering a broad foundation of science upon which a superstructure of technique can be built, and the second beginning with observation and practice and calling upon science for necessary explanations. The former has been the more common in the past but is considered pedagogically and practically inferior to the second, inasmuch as science should follow agriculture in the curriculum. In the author's opinion the course of study should be made up by a board of specialists more or less trained in the problems of education.

For securing correlation of departmental work the following three principal methods are found in vogue: (1) The formation of large departments with many specialist assistants; (2) the grouping of related departments into larger divisions headed by deans or division chiefs; and (3) the obliteration of department lines and the organization of the work about men or problems.

It is recommended that the different forms of agricultural teaching, viz, graduate teaching, the bachelor's or four-year course, the two-year course, the short courses, and extension teaching, should be more clearly separated than they have been in the past. Graduate work in technical agriculutre, now greatly needed, should be organized on a different basis and pursued by quite different methods than is the work in existing graduate schools which are adapted to science teaching. For the immediate future such agricultural graduate courses should give considerable normal school work.

As regards specialization, which has been a great factor in the development of the agricultural college, no department should give more than 10 undergraduate courses. The technical subjects (agriculture, horticulture, and domestic arts) are essential for vocational training and must command the whole curriculum, while all other subjects must support them and be taught in sympathy with the professional point of view.

With reference to pedagogical methods now in use, in the author's opinion the professional field camps offer one of the best methods in sight for technical instruction in agricultural and horticultural subjects. The textbook method is better in the lower grades, but should not be used alone. The lecture method is the poorest and should be used as little as possible, while the new type of laboratory work, called the project method, is worthy of wider application, not only in high schools but in college work. Finally, however, more depends on the teacher than on the pedagogical methods adopted.

The colleges are deemed justified in making farm experience a requirement for matriculation, but unless the students lacking such experience are strictly excluded, the college should make serious effort to supply the deficiency before graduation.

Report of a survey made for the Milwaukee Taxpayers' League, W. MATSCHECK (*Madison, Wis.: Wis. Efficiency Bur., 1916, pp. 73*).—This survey of the Milwaukee County School of Agriculture and Domestic Economy contains a report on the organization, history, land, buildings and equipment, students, graduates, courses of study, teaching staff, teaching, extension activities, school farm, and school finances, with a discussion and recommendations and a summary of findings.

Canada's intellectual status and intellectual needs, A. BAKER (*Proc. and Trans. Roy. Soc. Canada, 3. ser., 10 (1916), pp. XXXIX–LXXII*).—In this discussion of the intellectual status and needs of the people of Canada the author includes a review of the extent to which technical and agricultural instruction has been introduced into the various Provinces.

Agricultural education and research in Canada, F. T. SHUTT (*Proc. and Trans. Roy. Soc. Canada, 3. ser., 10 (1916), Sect. III, pp. 1–17*).—The author discusses the status of agriculture in Canada, the value of science in agriculture, and the improvement of the practice of agriculture in Canada through education, demonstration, and research.

[Agricultural education and research in the Province of Quebec, 1914–15] (*Rpt. Min. Agr. Proc. Quebec, 1915, pp. XX+284, pls. 53, figs. 8*).—This report on the progress in the work of the department of agriculture for the Province of Quebec in 1914–15 includes an account of the work of the agricultural and domestic-science schools, experiment stations, and extension work under the control of the department.

Report of the schools' division of the experimental union, S. B. McCREADY (*Ann. Rpt. Ontario Agr. and Expt. Union, 37 (1915), pp. 49–60*).—A general survey is given of the origin, purposes, and accomplishments of the schools' division of the Ontario Agricultural and Experimental Union. This division, begun in 1909, is a cooperative association in education which grew out of this union and the nature-study department organized as a part of Macdonald Institute in 1904.

School gardens, 1915, J. C. MAGNAN (*Les Jardins Scolaires, 1915. Quebec: Min. Agr., 1916, pp. 16, pls. 6; Rpt. Min. Agr. Prov. Quebec, 1915, pp. 215–227, pls. 4*).—In this report of progress in school garden work in the Province of Quebec the author discusses some difficulties met and their solutions and interesting results. It is shown that the number of pupils taking school-garden work increased from 425 in 1906 to 9,308 in 1914, and the number of schools having gardens from 60 in 1907 to 284 in 1914.

The teaching of household science (*Agr. Gaz. Canada, 3 (1916), No. 12, pp. 1098–1103*).—This is an account of the present status of instruction in home economics in the Provinces of Nova Scotia, Ontario, Manitoba, Saskatchewan, and Alberta.

Agricultural education for women (*Rpt. Agr. Ed. Conf. [Gt. Brit.], 1915, pp. 84*).—This report on agricultural education for women in England and Wales is based on an inquiry made at the request of the Board of Agriculture and Fisheries. It considers (1) the conditions affecting the instruction of women in agriculture, including the scope of agricultural education and the different classes of women for whom agricultural instruction is needed; (2) the existing facilities for the instruction of women in agriculture, classified as itinerant instruction, farm schools or institutes, agricultural and horticultural colleges, and university institutions; and (3) women's agricultural institutes.

The conference concludes that itinerant instruction should take the form of organized classes rather than that of lectures, and every part of a county should be covered in a definite cycle of years. The number of farm schools or fixed courses of instruction should be so increased as to provide one for every county or two counties. A systematic long course for women, covering all branches of agricultural work (practical and scientific), should be organized at one of the existing agricultural colleges. Scholarships from itinerant classes to farm schools and from farm schools to collegiate institutions, as well as for the daughters of the larger farmers and professional men at collegiate centers, should be provided. Home economics should form part of the curriculum in every organized course. A training course for poultry teachers

should be given at one of the existing agricultural colleges and a national examination in poultry be held. At least two women members should be added to the county committees of agricultural education and a woman should be employed in inspection work by the Board of Agriculture and Fisheries, and the organization of women's institutes should be encouraged.

Summaries of oral evidence before the conference, statistics on the employment of women in agriculture, and a memorandum by the secretary on the facilities for agricultural education for women in England and Wales, the extent to which women are and might be employed in agricultural work in England and Wales, with particulars of the farm operations performed and particulars of scholarships free to women students in agricultural courses in 1914–15, are appended.

Agricultural reeducation of the maimed (*Vie Agr. et Rurale, 6 (1916), No. 49, pp. 401–424, figs. 28*).—This number is devoted to a description of the facilities in France for the agricultural reeducation of soldiers maimed in the war.

Our field and forest trees, MAUD GOING (*Chicago: A. C. McClurg and Co., 1916, pp. [10]+222, pls. 18, figs. 35*).—This book, which is intended for the high school student and the "man in the street," treats of the various parts of the tree, together with their functions, wasteful lumbering and tree diseases, the relation of woods, river, and the rain, the uses of wood, and the question of a wood famine, forest fires, U. S. National Forests, Canadian forest reserves, and the forester and his work. The book is arranged in seasonal sequence for the convenience of the teacher and endeavors to avoid technical terms and phrases.

Exercises in poultry husbandry for high schools, W. E. EVANS and F. G. BEHRENDS (*[Ithaca, N. Y.: Authors, 1916], pp. 78, fig. 1*).—Thirty-nine laboratory exercises in poultry husbandry, adapted to the needs of high schools, are outlined. They include a poultry survey and a study of the fowl, parasites, incubation, brooding, the egg, the preparation of poultry products, poultry houses, feeds, identification of varieties, a visit to a poultry show, and a critical examination of a poultry farm. Two-week schedules for 10 students in a poultry course, in conjunction with farm shop work, are suggested. An appendix in 36 parts, consisting of questions and references to literature, may be used for review or as work in connection with the student's preparation for the home project.

List of workers in subjects pertaining to agriculture and home economics in the U. S. Department of Agriculture and in the state agricultural colleges and experiment stations (*U. S. Dept. Agr., List of Workers in U. S. Agr., 1917, pp. 88*).—This is the annual organization list of workers along these lines (E. S. R., 34, p. 94), corrected to January, 1917.

MISCELLANEOUS.

Report on agricultural experiment stations and cooperative agricultural extension work in the United States for the year ended June 30, 1915 (*U. S. Dept. Agr., Rpt. Agr. Expt. Stas. and Coop. Agr. Ext. Work, U. S., 1915, pp. 321+364, pls. 12*).—This report, prepared by the States Relations Service, consists of two parts.

Part 1 includes the usual report on the work and expenditures of the agricultural experiment stations in the United States, including Alaska, Hawaii, Porto Rico, and Guam, together with detailed statistics compiled from official sources as to the organization, revenues, additions to equipment, and expenditures of the stations.

The total income of the stations during the fiscal year 1915 was $5,286,382.53. Of this amount $718,679.91 was derived under the Hatch Act, $719,699.66 under the Adams Act, $2,129,604.04 from State appropriations, $23,003.49 from individuals and communities, $343,087.66 from fees, $514,220.47 from farm products, and $716,466.87 from miscellaneous sources. The value of additions to the equipment of the stations was estimated at $1,135,980.04, of which $537,665.45 was for buildings.

The stations employed 1,857 persons in the work of administration and inquiry. Of this number 892 were also members of the teaching staff of the colleges and 466 assisted in farmers' institute and other extension work. During the year the stations published 1,676 annual reports, bulletins, and circulars, aggregating 39,867 pages, and these were distributed to 1,114,261 addresses on the regular mailing list.

Part 2 comprises a report on the receipts, expenditures, and results of cooperative extension work in agriculture and home economics in the United States. Of this, pages 13–144 are devoted to Extension Work in the South, pages 145–326 to Extension Work in the North and West, pages 327–334 to Farmers' Institute Work, 1915, by J. M. Stedman, and pages 335–353 to statistics of farmers' institute and extension work. The text of the Smith-Lever Act is appended.

Twenty-ninth Annual Report of Indiana Station, 1916 (*Indiana Sta. Rpt. 1916, pp. 100, figs. 8*).—This contains the organization list, reports of the director and heads of departments, the experimental features of which are for the most part abstracted elsewhere in this issue, and a financial statement for the federal funds for the fiscal year ended June 30, 1916, and for the remaining funds for the period ended September 30, 1916.

Twenty-ninth Annual Report of Michigan Station, 1916 (*Michigan Sta. Rpt. 1916, pp. 241–868, figs. 111*).—This contains reports of the director and heads of departments on the work of the station during the year, the experimental features of which are for the most part abstracted elsewhere in this issue; a financial statement for the fiscal year ended June 30, 1916; and reprints of Bulletin 275, Special Bulletins 74–79, Technical Bulletins 20–27, and Circulars 28–30, all of which have been previously noted.

Monthly Bulletin of the Ohio Experiment Station (*Mo. Bul. Ohio Sta., 1 (1916), No. 12, pp. 353–391, figs. 15*).—This contains several articles abstracted elsewhere in this issue, and Winter Heating of Peach Orchards, by W. J. Green.

NOTES.

California University and Station.—A state survey of crop and live stock conditions in California and the possibility of increasing production was conducted during April by members of the staff of the College of Agriculture, cooperating with the various state officials, the Forest Service of the U. S. Department of Agriculture, and others.

Recent promotions and changes in title include the following: As professors, L. D. Batchelor in plant breeding (in the Citrus Substation and Graduate School of Tropical Agriculture at Riverside), B. A. Etcheverry in irrigation engineering, and C. L. Roadhouse in dairy industry; as associate professors, R. L. Adams and P. B. Kennedy in agronomy, and D. N. Morgan in agriculture (and assistant to the director of the station); as assistant professors, H. S. Baird in dairy industry (at the University Farm at Davis), G. P. Gray in entomology (and chemist in the insecticide laboratory), W. H. Heilemann in agricultural extension, A. H. Hendrickson in pomology, G. W. Hendry in agronomy, P. L. Hibbard in agricultural chemistry, and W. P. Tufts in pomology (at the University Farm); and as instructors, E. O. Amundsen and J. W. Mills in agricultural extension, J. R. Beach in veterinary science, Earl Bisbee in dairy industry, A. W. Christie in agricultural chemstry, W. C. Dean in soil technology, P. T. Peterson in veterinary science (in charge of serum manufacture), and W. L. Sweet in pomology. George H. Hart has been appointed professor of veterinary science; J. C. Bradley, of Cornell University, assistant professor of entomology for one year in exchange with E. C. Van Dyke; H. M. Butterfield, instructor in agricultural extension; R. W. Hodgen, instructor in citriculture; G. F. Fermery, assistant in agricultural engineering; and J. C. Martin, assistant in agricultural chemistry. Leave of absence was granted for the ensuing year to H. S. Fawcett, associate professor of plant pathology in the Citrus Substation and Graduate School of Tropical Agriculture, and to N. L. Gardner, assistant professor of botany, from July 1 to January 1, 1918.

Delaware College and Station.—The increased state appropriations to the agricultural department have made possible a considerable enlargement of the station staff. A new division of plant physiology has been organized, with Ernest M. R. Lamkey, Ph. D., of the University of Illinois as its head, beginning about April 16. W. J. Young has been appointed assistant in horticulture beginning April 1, C. E. Neff, assistant in agronomy beginning April 16, and M. O. Pence, assistant state leader of county agent work in the extension service, beginning July 1.

Georgia College.—John M. Purdom, jr., was succeeded as editor, May 1, by H. T. Maddux.

Idaho University.—President M. A. Brannon has tendered his resignation.

Massachusetts College.—About 40 acres of land, previously not used for production purposes, are to be under cultivation to increase the food supply. A part of this area has been in lawn and another tract was originally set aside for recreation purposes.

College credit for the remainder of the term has been granted to students enlisting in military or other forms of mobilization duty, or to engage in food-production service. On May 1 only about 100 students remained at the institution.

The attendance at Farmers' Week this year reached over 800.

Minnesota University.—On May 5, after a general exodus to engage in various forms of agricultural or military service, only 30 men were left in the College of Agriculture. Many of these were enrolled in three special short courses instituted for preparing traction engineers, extension field assistants, and directors of school and community gardens.

Nebraska University and Station.—Under an act of Congress, signed March 3, the Secretary of the Interior is authorized to transfer to the university for use in dry land experiments, a tract of about 800 acres of public land adjoining the Scottsbluff Substation.

New Jersey College and Stations.—An act of the recent legislature changes the method of appointment of members of the board of managers of the State Station. The new system provides for a board of 21 members, one from each county. This change from the basis of appointment by Congressional districts is expected to increase the representation of the rural sections on the board.

Julian Miller and A. M. Hulbert have succeeded L. G. Gillam and W. H. McCallum, respectively, as extension specialist in fruit growing and state leader of boys' club work. W. S. Krout has resigned as assistant in plant pathology to become field plant pathologist in the Massachusetts Station. Charles H. Nissley has been appointed specialist in the extension division.

Cornell University.—The legislature has appropriated $779,401 for the College of Agriculture for the ensuing year, in addition to an earlier emergency grant of $55,910 for the present year and $42,000 for printing. Of the new appropriation, $34,000 is allotted for new construction and improvements, of which $12,000 is for an additional unit to the central heating plant, $7,000 for a new piggery, and $1,000 for a packing shed on the pomology grounds.

The university graduated on March 29 all seniors in good standing who might wish to serve their country in military service or industrial pursuits, and granted "leave of absence without prejudice" to other students under the same conditions. By April 27, 507 leaves of absence had been granted in the College of Agriculture and further leaves were being issued at the rate of from 25 to 30 per day. Of those already granted, 144 students were in the Army or Navy or in munitions plants, 10 were under military training at the university, and 353 were on farms or other agricultural activities.

R. I. Scoville, instructor in dairying, has resigned to become assistant professor in dairy manufactures in the Oregon College, beginning in March. B. W. Shaper, instructor in extension teaching, has been appointed assistant director of the extension service at the Massachusetts College, beginning March 1. Benjamin Smith has been appointed assistant in plant pathology.

Oklahoma College and Station.—A science building to cost $100,000 was authorized by the last legislature.

Glen Briggs, student assistant in the college and station, resigned March 27 to become agronomist at the Guam Station, and has been succeeded by Roy T. Hoke of the senior class.

Porto Rico Federal Station.—William P. Snyder has been appointed plant breeder.

South Dakota College and Station.—Appropriations made by the state legislature include $80,000 for an armory, $100,000 for the completion of Agricultural Hall, $10,000 for a health laboratory, $10,000 for the manufacture of hog cholera serum, $20,000 for a fireproof stock judging pavilion, $3,000 for a poultry department, $10,000 for the purchase of pure bred live stock, and $5,000 for feeding experiments with live stock. This is the first appropriation made by the State for experimental work. It is desired to take up some experiments with poultry, as this is becoming an important industry in the State.

Thomas D. Potwin of Lemon has been appointed a member of the Regents of Education, vice A. M. Anderson of Sturgis.

U. S. Department of Agriculture.—Dr. B. T. Galloway of the Department and President R. A. Pearson of the Iowa College have been appointed assistants to the Secretary of Agriculture. Dr. Galloway's duties are primarily to act as the representative of the Department in matters connected with the Council of National Defense, while President Pearson will especially assist the Department in keeping in touch with the state boards of food production and conservation which are being organized.

A departmental committee, consisting of R. A. Oakley, chairman, L. M. Estabrook, W. A. Wheeler, J. E. W. Tracy, Wm. Stuart, C. P. Hartley, A. J. Pieters, and C. W. Warburton, has been appointed to secure information as to the available supplies of seed for staple food crops, and to devise methods of meeting shortages in particular regions.

A survey by the Department of the farm-labor situation in the various States is contemplated. Steps are also being taken to place a representative in each State to cooperate with other agencies in organizing farm labor and assist farmers in receiving an adequate supply.

Two new divisions have been established in the Bureau of Animal Industry beginning May 1. One of them is the tuberculosis eradication division, to take charge of work which is to be considerably enlarged under the new appropriation act. The other is the tick eradication division, which will deal exclusively with this campaign, leaving the field inspection division free to devote itself to the enforcement of the cattle transportation laws and the combating of miscellaneous animal diseases.

Fourth National Conference on Rural Education.—This conference was held at the University of Pennsylvania, April 8 to 11, under the auspices of the U. S. Bureau of Education. The attendance was about 175, representing over 20 States.

The opening day's session dealt with religious agencies in rural life and rural education. The remainder of the program considered a nation-wide plan for the improvement of rural schools and the development of rural leadership.

Among the resolutions adopted were those favoring means to provide more adequate preparation of rural teachers, the consolidation of rural schools where practicable, and the maintenance of a teachers' home and a demonstration farm of five or more acres as part of the school property. The utilization of the country school as an intellectual, industrial, educational, and social center for community organization, the readjustment of courses of study in elementary and secondary schools to adapt them to the needs of rural life, and the provision of high school education for all country boys and girls without severing home ties, were also advocated. A special recommendation for the present emergency was for the mobilization of the boys of high school age in cities and towns into an industrial army as farm cadets, to be employed by farmers during their busy season under state and national supervision and to receive school credits as well as pay for their labors.

Agricultural Education and Research in Great Britain.—A movement is on foot to raise a fund of $750,000 for the erection of new science buildings at the University College of North Wales "as a memorial to the men of North Wales who have fallen in the war." A gift of $100,000 has already been secured. It is announced that special prominence is to be given in the new buildings to agriculture and forestry.

The Southeastern Agricultural College at Wye, England, has organized a research and advisory department distinct from the teaching side of the college and governed by a separate representative committee, composed in part of re-

search workers at the institution and in part of other scientific men. Some of the work in progress and in contemplation includes problems connected with the general practice of fruit growing, the biological study of flax, the conservation of fruits and vegetables, pasture studies, diseases of sheep, hop breeding, and fungus diseases and insect pests and their treatment by spraying.

Agricultural Education and Experimentation in China.—Considerable attention is now being devoted in China to agricultural education and experimentation in various classes of institutions. An experiment station was located at Peking in 1907 under the control of the board of agriculture, industry, and commerce. An experimental tract of nearly 300 acres is available, and departments of crops, soils, animal husbandry, horticulture, floriculture, entomology, botany, forestry, bacteriology, and biology have been put in operation. In 1908 an agricultural college was organized in connection with the station, but this was disbanded in 1915.

Subsequently an agricultural college and experiment station was established at the capital of each province along much the same lines as at Peking, and many other stations in addition. There are now reported to be 130 stations in the 22 provinces, of which 31 are in Chihli, 25 in Szechwan, 15 in Hu-Long-Kiang, 7 in Hupeh, and 7 in Kwangtung.

Among these are two cotton experiment stations, one at Cheng Ting Hsien, Chihli, and one at Nan T'ung Chou, Kiangsu, with a third under consideration at Tung Haing Chou, Hupeh. Experiments are being conducted at these stations in seed selection, seed distribution, plant harvesting, soils and manures, treatment of pests, and cotton weaving. A corps of students is also being trained at these stations. H. H. Jobson is in charge of the organization of the cotton work, with H. K. Fung as associate.

Stock-raising experiment stations have been established at Kalgan and Shih Men Shan, Anhui. These are expected to study the improvement of breeds of domestic animals, promote the breeding and sale of stock and stock raising enterprises, and the cultivation of forage crops.

Considerable attention is also being devoted to forestry in China. A department of forestry was organized in January, 1916, with a forestry commissioner in each province. Forestry experiment stations and training schools have been established at Ch'ang Ch'in Hsien, Shantung, and in the Temple of Heaven at Peking.

The university at Nanking has maintained a college of agriculture and a school of forestry for several years. This is an American-supported institution, and in 1915 had enrolled about 70 students in agriculture. A colonization association has been organized under its auspices, with provision for the reservation of about 35 acres in each colony for a model farm. A tract already purchased on Purple Mountain, just outside Nanking, is to be used as an experiment station in connection with the different colonies.

An agricultural experiment station was opened at Nanhsuchou, Anhwei, in 1915, as a part of the American Presbyterian mission station. Agricultural work was taken up at this institution partly as a practical way to teach Christianity, partly to make friends, and partly to improve economic conditions. The station is located on the railway between Nanking and Tientsin, and attempts to serve an area of about 6,000 square miles and from 1,500,000 to 2,000,000 people. The farming methods in use are those of from one to two thousand years ago. Special prominence is being given in the experimental work to seed selection, better tillage methods, more and better fertilization, drainage, and animal husbandry. The work is to be largely of a demonstration nature during the present pioneer stage, and will also include an agricultural

school, a school farm, and short winter courses for farmers. J. Lossing Buck has been in charge of the agricultural work at the station from the outset.

Necrology.—Professor Herbert W. Conn, widely known as a pioneer worker in dairy bacteriology in this country, died at Middletown, Connecticut, April 18.

Professor Conn was born at Fitchburg, Massachusetts, January 10, 1859, was graduated from Boston University in 1881, and received the Ph. D. degree from Johns Hopkins University in 1884. His long period of service was spent entirely with Wesleyan University, commencing as instructor in biology in 1884, as assistant professor from 1886 to 1889, and subsequently as professor of biology. He was also bacteriologist of the Connecticut Storrs Station from 1890 to 1896, a member of the Board of Control of the Connecticut State Station since 1908, director of the Cold Spring Harbor Biological Laboratory from 1889 to 1907, and director of the laboratory of the Connecticut State Board of Health since 1905. He was likewise closely associated with the New York Milk Committee and numerous health organizations and related bodies.

Professor Conn's work covered a large range of scientific inquiry, but he specialized in the bacteriology of dairy products. He was one of the earliest workers in this country on problems connected with certified milk, the use of pasteurized cream and pure bacterial cultures in butter making, and the bacteriological examination of municipal milk supplies. He was the author of several text books, mostly on bacteriological subjects, of which his Agricultural Bacteriology is especially well known. He had also contributed over 150 scientific memoirs and other articles, many of these appearing in publications of the Connecticut Storrs Station. He was one of the founders, and for 15 years president, of the Society of American Bacteriologists.

New Journals.—*Abstracts of Bacteriology* is the title of a new bi-monthly abstract journal published by the Society of American Bacteriologists, with A. Parker Hichens as editor, George H. Smith as associate editor, and a numerous corps of abstract editors and abstractors. The initial number contains, in addition to abstracts of current literature and book reviews, a list of the periodicals to be reviewed and a summary of the scientific proceedings of the eighteenth annual meeting of the society, held at New Haven, Connecticut, December 27–29, 1916.

With the year 1917 *Forestry Quarterly*, which completed its fourteenth volume in December, 1916, will be amalgamated with the *Proceedings of the Society of American Foresters* under the title *Journal of Forestry*. The new magazine is to be published in eight monthly issues, containing approximately as many pages as the two original publications together. It is announced that the character of the new journal will remain essentially the same as the present publications.

Veterinary Review is a new quarterly published in London and Edinburgh, with Dr. O. C. Bradley, principal of the Royal (Dick) Veterinary College of Edinburgh, as editor. The initial number contains a brief article by R. G. Linton on Feeding and Economy, and about 95 pages devoted to abstracts of current veterinary literature, book reviews, and an extensive bibliography.

The Journal of the Board of Commissioners of Agriculture, Porto Rico, is being published under the direction of W. V. Tower, director of the Insular Experiment Station, and with John A. Stevenson as editor. The initial number contains A List of the Coccidæ of Porto Rico, by T. H. Jones, and History and Cause of the Rind Disease, by J. R. Johnston.

The Secretary of Agriculture, Commerce, and Labor of Cuba is publishing a monthly periodical known as *Agriculture*. This publication is to be devoted entirely to agricultural extension articles for the purpose of bringing the farmers into close touch with agricultural progress.

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A. C. TRUE, DIRECTOR

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EXPERIMENT STATION RECORD.

VOL. 36. ABSTRACT NUMBER. No. 9.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Work of the chemical and yeast culture laboratory, W. SEIFERT ET AL. (*Programm u. Jahresber. K. K. Höh. Lehranst. Wein- u. Obstbau Klosterneuburg, 1912–13, pp. 103–155, fig. 1; 1913–14, pp. 106–157, pl. 1, figs. 2; 1914–15, pp. 76–89; 1915–16, pp. 84–115, fig. 1*).—These pages contain tabular analytical data relative to the total acidity, solids, total sugars, and invert sugar of the wines and musts handled at the institute from 1912 to 1916.

The report for 1912–13 also deals with the results of a study on the inversion and disappearance of tartaric acid, the determination of tartaric acid in the presence of citric acid, the advantage of using pure yeast cultures for fermentation of musts from partly fungus-diseased grapes, further tests on pure yeast fermentations, the refermentation of strong wines to an alcohol content of 13 per cent by volume, the action of pure nitrogen on musts and wine, the action of chloroform and mustard oil on the alcoholic fermentation of grape must, decolorization with "Eponite" and French decolorizing charcoals, and the results of tests of some mechanical appliances. That for 1913–14 contains the results of a study of wine and must concentration by freezing, the cooling and airing of young wine to accelerate its ripening, the formation of volatile acids during the fermentation of a sterile, a pasteurized, and an untreated apple juice, the formation of volatile acids during fermentation with juices of increasing sugar content, the effect of yeast on tartaric acid during fermentation, the adaptation of yeast to the presence of sulphurous acid, the influence of chloroform and mustard oil on the alcoholic fermentation of grape must, the action of sulphurous acid on the coloring substances in red wine, decolorization tests with certain commercial charcoals, the cleaning of casks which have stood unused for some time, and descriptions of a wine sampler and a pasteurizing apparatus. That for 1914–15 presents the results of a study on the adaptation of yeast to sulphurous acid and the use of pure yeast cultures for refermentations. That for 1915–16 includes the results of a study of the formation and disappearance of acetaldehyde in grape must during and immediately following fermentation, the preparation of vinegar from wine by Pasteur's method or the rapid procedure, the possibility of wine extracting sulphur dioxid from the wood of paraffined casks, partial neutralization of wines with calcium carbonate, conserving empty casks with alcohol and formaldehyde, rinsing of wine bottles with sulphurous acid, the removal of grape seeds from husks, the lowering of temperature to accelerate the ripening of the wine, and replacing the air of bottles with carbon dioxid before filling are reported.

On the presence of invertase in cane sugar, H. PELLET (*Bul. Assoc. Chim. Sucr. et Distill., 33 (1916), No. 10–12, pp. 263–266*).—The author has observed that either a pure or impure solution of sucrose on standing for some time becomes inverted even in the presence of toluene. The inversion is greatest in the pure solution. If the sucrose solution is previously boiled no inversion takes place. The maximum temperature for the action was found to be from 55 to 57° C.

To prevent such loss during the process of cane sugar manufacture the use of concentrated solutions, rapid heating to a temperature of from 90 to 100°, or the use of alkali and a lower temperature to destroy the invertase are recommended.

See also a previous note by Lewton-Brain and Deerr (E. S. R., 21, p. 420).

The autolysis of grapes, E. PANTANELLI (*Staz. Sper. Agr. Ital., 48 (1915), No. 10–11, pp. 783–821, figs. 3*).—Having found in earlier experiments that the must of ripe or overripe grapes contains a protease, the action of which appears to increase when the grapes are dried in the air, further experiments were conducted on the autolysis of the protein of the normally ripened grape and the decomposition of the carbohydrates under aerobic and anaerobic conditions.

It was found that there was an autolysis of the albumin and a decomposition of the sugars and acids to a limited degree in ripe grapes (removed from the plant and kept whole) when exposed to the air, and to a greater extent when immersed in sterile water. It is concluded that under anaerobic conditions the mature grape forms alcohol by intracellular respiration of the sugar without the intervention of alcoholic ferments.

A study of the yeasts of wine, E. KAYSER (*Rev. Vit., 45 (1916), Nos. 1158, pp. 149–155; 1159, pp. 165–170*).—This is a general discussion of experimental data submitted in tabular form. The effect on the finished product of the kind of yeast used and the amount of nitrogenous and mineral constituents present in the fermentation is emphasized.

The relative influence of microorganisms and plant enzyms on the fermentation of corn silage, A. R. LAMB (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 10, pp. 361–380, figs. 13*).—The author at the Iowa Experiment Station briefly reviews the literature on silage fermentation and emphasizes the difficulty encountered in an attempt to differentiate between the activity of microorganisms and plant cell enzyms in the process of fermentation. Experimental data on silage made under antiseptic conditions, the rate of chemical changes in the silage fermentation, the evolution of carbon dioxid, and the rise in temperature are reported and discussed.

It is concluded from the data that neither microorganisms nor plant enzyms are alone responsible for the changes which take place in corn silage fermentation. Bacteria appeared to be mainly responsible for acid production and the concomitant disappearance of sugars. The formation of alcohol appears, however, to be a phenomenon primarily of the respiratory or enzymatic activity of the plant cells, and later to be carried on by the yeasts. Protein is hydrolyzed first by enzyms and later by microorganisms. The microorganisms are deemed probably largely responsible for the heating of the silage.

A bibliography of 27 references to the literature is appended.

Cytological researches in the fermentation of a fruit "compound," NATALINA DONNA (*Ann. R. Accad. Agr. Torino, 58 (1915), pp. 334–340*).—This article discusses the changes in the plasma and nuclei of the cell during fermentation, changes in the nitrogenous substances, and modifications of the structure of the parenchyma.

Plant oils, I, II, S. L. IVANOV (*Soobshch. Bīūro Chastn. Rast. [Petrograd], 2 (1915), Nos. 1, pp. 3–22; 7, pp. 39–45*).—From analytical data reported in the

first of these papers, the author concludes that each closely related group of plants develops a distinct and characteristic oil content which is peculiar to every species of a given genus. The results are considered to be significant not only for the systematic botanist, since they render a physiological criterion for natural classification of higher and lower forms, but also have a practical value in regard to the propagation and culture for industrial purposes of plants which have been neglected in the past.

It is noted in the case of *Spergula arvensis* that the seed oil undergoes a marked physiological and chemical change during the storage period, forming a coating impermeable to water and so retarding germination.

Analytical data of certain yeasts, Chlorophyceæ, Gymnospermæ, and several species of Juglans and Linum are submitted.

In work reported in the second paper he found that the composition of the walnut oils from different localities of Europe and Asia remained constant. Sunflower seed collected in two different Provinces, Kharkof and Voronezh, showed no essential difference. The oil of *Hyoscyamus niger* was found to be formed gradually, and the oil of the immature seeds differed from that of the ripe seeds.

Chemical composition of certain ethereal oils of Russian origin, G. V. PIGULEVSKIĬ (*Soobshch. Biūro Chastn. Rast.* [*Petrograd*], *3* (*1916*), *No. 3*, *pp. 3–16*).—The oils were analyzed of *Ruta graveolens*, *Rosmarinus officinalis*, *Ocymum basilicum*, *Laurus nobilis*, *Hyssopus officinalis*, *Salvia grandiflora*, and *Lavandula spica*, and the data submitted. It was found that the Crimean ethereal oils do not differ essentially from the imported oils. It is indicated that the vast natural resources and favorable climatic conditions of Russia will greatly stimulate the development of the oil industry in that country.

Some new oil seeds derived from American palms, G. T. BRAY and F. L. ELLIOTT (*Analyst*, *41* (*1916*), *No. 487*, *pp. 298–302*.)—Tabulated analytical data of the composition of the kernels as regards moisture and oil content and the physical and chemical constants of the oils obtained from a number of seeds of South American and West Indian palms are submitted. The seeds were, on the whole, found to be as rich as or richer than those of ordinary West African palms.

Notes on the oils obtained and the press cake of the kernels are included.

Plum oil and its relation to other oils of the genus Prunus, S. L. IVANOV (*Soobshch. Biūro Chastn. Rast.* [*Petrograd*], *2* (*1915*), *No. 7*, *pp. 46–55*).—The author finds no essential difference in the composition of the oils from various species of Prunus. The simplest oil of this genus is considered to be that of the domestic plum (*Prunus domestica*). Apricot seeds give at least 25 per cent of oil.

Methods used in the analyses are described in detail.

Physiological characters of plants and botanical families.—I, Malvaceæ.—Oil and fiber, S. L. IVANOV and N. F. KOKOTKINA (*Soobshch. Biūro Chastn. Rast.* [*Petrograd*], *2* (*1915*), *No. 7*, *pp. 3–24*).—The results of the investigation reported are as follows:

There are many valuable species of Malvaceæ which as yet are not used commercially, such as *Lavatera thuringiaca*, Malva, and other fiber species. The oils of the 30 species of Malvaceæ which were studied do not differ essentially from cottonseed oil. The oils of the Malvaceæ and those of the nearest forms of the Tiliaceæ are both characterized by Halphen's reaction, which indicates the presence of a peculiar unsaturated acid in these groups. The presence and the formation of this acid unites these two families as their common physiological character.

The hairs of the seed coating of some of the other species of Malvaceæ are considered to be very similar to cotton fiber. The possibility of successful crossings between Gossypium and other Malvaceæ is suggested.

Data concerning the character of seeds of different varieties of cotton, S. L. IVANOV and E. I. MOSHKOVA (*Soobshch. Būro Chastn. Rast. [Petrograd], 2 (1915), No. 4, pp. 3–35*).—From an investigation of several species and varieties of Gossypium, arranged by the Russian Ministry of Agriculture with regard to the cotton industry in Russian central Asia, it was found that, considering the quality of seeds from the standpoint of oil content and press cake and the quality of fiber, *Gossypium hirsutum* has a much greater practical value than any other variety studied. It is indicated that the cultural area of *G. hirsutum* is gradually extending, while that of *G. herbaceum* is gradually diminishing.

Tables giving detailed analytical results of a number of cotton seeds are appended.

Globulin obtained from seeds of Gossypium hirsutum, A. POMASKIĬ (*Soobshch. Būro Chastn. Rast. [Petrograd], 2 (1915), No. 2, pp. 3–12*).—The author finds that globulin is the chief constituent of the protein substances of the cotton seeds. The globulin of *G. herbaceum* and that of *G. hirsutum* are probably identical. The proteins of the cotton seed are considered to be highly digestible, the coefficient of digestibility with the gastric juice of the dog being found to be from 99 to 100 per cent. The value of the press cake as a feeding stuff is indicated.

Leucin anhydrid, a product of the water hydrolysis of protein at high temperatures, S. S. GRAVES, J. T. W. MARSHALL, and H. W. ECKWEILER (*Jour. Amer. Chem. Soc., 39 (1917), No. 1, pp. 112–114*).—The following percentages of leucin anhydrid were extracted with ether from the brown, sirupy liquid resulting from hydrolysis with water in an autoclave at from 180 to 200° C. for 16 hours: Casein, 1.5; egg albumin, 1.2; edestin, 1.2; Witte's peptone, 1; silk, 0.09; gelatin, 0.04. The material extracted by the ether was purified by recrystallization from hot acetone. An experiment to determine the source of the leucin anhydrid is reported and indicates that the anhydrid is not built from any leucin separated by the hydrolysis.

An iodin addition product of cumarin, A. W. DOX and W. G. GAESSLER (*Jour. Amer. Chem. Soc., 39 (1917), No. 1, pp. 114–117*).—The authors at the Iowa Experiment Station describe the preparation of an iodin addition product of cumarin containing approximately 33 per cent of iodin. Analysis of the product showed that no substitution by the iodin occurred.

Carbon monoxid, occurrence free in kelp (Nereocystis luetkeana), S. C. LANGDON (*Jour. Amer. Chem. Soc., 39 (1917), No. 1, pp. 149–156, figs. 3*).—Experimental data are reported which show that the gas in the giant kelp (*N. luetkeana*) contains carbon monoxid in quantities varying considerably in different samples. Carbon dioxid is only occasionally present, and in minute quantities. Previous work which demonstrated that the quantities of carbon dioxid and oxygen varied with the time of day has not been confirmed.

Ancient Irish oak, P. A. E. RICHARDS (*Analyst, 41 (1916), No. 487 pp. 303, 304*).—Data relative to the general composition and mineral constituents of a number of Irish oaks taken from various districts are submitted.

Photomicrographs of crystallizable chemical salts, A. W. DOUBLEDAY (*Boston: Research Publishing Co., 1916, pp. V+236, figs. 115*).—This volume contains 114 photomicrographs of typical crystalline forms of various chemical compounds known to exist in the body tissues and fluids under normal and pathological conditions. Brief notes on crystallization and a description of the six crystal systems are included.

Some laboratory conveniences, A. E. Perkins (*Jour. Indus. and Engin. Chem., 9 (1917), No. 1, pp. 57, 58, figs. 4*).—The author, at the Ohio Experiment Station, describes a special flat-bottomed Kjeldahl flask for use with the extraction apparatus previously described[1]; a convenient, satisfactory, and easily assembled burette support; two convenient pipettes for sampling milk and milk products; and a novel and convenient drying rack for laboratory glassware.

Carbon dioxid absorption apparatus, L. G. Wesson (*Jour. Indus. and Engin. Chem., 9 (1917), No. 1, p. 59, fig. 1*).—A simple apparatus consisting of a cylindrical bulb for carbon dioxid absorption with soda lime and a smaller arm attachment to contain the drying agent is described.

Apparatus for the recovery of bromin, C. H. Collings (*Chem. News, 114 (1916), No. 2975, pp. 259, 260, fig. 1*).—An apparatus for the recovery of bromin from laboratory waste liquors and its manipulation are described in detail.

Note on the recovery of molybdic acid, P. Rudnick and R. D. Cooke (*Jour. Indus. and Engin. Chem., 9 (1917), No. 1, pp. 109, 110*).—The procedure, which is similar to that described by Brown[2], is as follows:

The phosphomolybdate solutions, after titration, are filtered through glass wool and combined with the filtrates and washings separated from the yellow precipitates. To this, an excess of saturated ammonium phosphate is added and after standing at least over night the supernatant liquid is siphoned off. When a convenient amount of ammonium phosphomolybdate has been collected in this manner it is washed by decantation with hot water and then dried on the steam bath. This material contains approximately 92 per cent of molybdic acid (85 per cent MoO_3). Of this dried salt 510 gm. is dissolved in ammonium hydroxid, made by diluting 620 cc. of ammonia (specific gravity 0.9) to 1,000 cc. To this, 85 gm. of magnesium nitrate in 200 cc. of water is added and after settling for two or three hours the filtrate is tested for phosphorus by adding a few cubic centimeters to double the amount of nitric acid (1:2.5). When precipitation is complete the magnesium-ammonium phosphate is filtered off, washed, and the filtrate made up to a volume of 2 liters. The ammonium molybdate solution is then added to the requisite amount of nitric acid and, after standing for some time, filtered.

Notes in regard to titration of sulphuric acid, C. R. Gyzander (*Chem. News, 114 (1916), No. 2975, pp. 260, 261*).—Analytical data showing the error that is likely to be introduced when an alkali is standardized with one indicator and then used for acid titrations with a different indicator are submitted and discussed.

Handling a standard solution of barium hydrate, W. G. Haynes (*Jour. Indus. and Engin. Chem., 9 (1917), No. 1, pp. 58, 59, fig. 1*).—An easily constructed attachment to the usual siphon arrangement used in filling burettes with standard barium hydroxid solutions and its manipulation are described in detail.

The use of the Cottrell precipitator in recovering the phosphoric acid evolved in the volatilization method of treating phosphate rock, W. H. Ross, J. N. Carothers, and A. R. Merz (*Jour. Indus. and Engin. Chem., 9 (1917), No. 1, pp. 26–31, fig. 1*).—The authors have applied the Cottrell precipitator in recovering the phosphoric acid evolved in the volatilization method of treating phosphate rock by ignition with coke and silica in an electric furnace The new method is claimed to possess a number of advantages over the scrubbing-tower method now in use.

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[1] Jour. Indus. and Engin. Chem., 5 (1913), No. 2, pp. 148, 149.
[2] Jour. Indus. and Engin. Chem., 7 (1915), No. 3, pp. 213, 214.

It is pointed out that the present application of the Cottrell precipitator is the first to be used for the precipitation of a product which has been purposely volatilized with a view to its recovery in this way.

The determination of total phosphorus in bone ash, F. PILZ (*Ztschr. Landw. Versuchsw. Österr., 19 (1916), No. 2, pp. 57–61*).—Comparative analytical data show that as accurate results can be obtained when the sample is oxidized with a mixture of sulphuric and nitric acids as when nitric acid alone is used. The preliminary precipitation as ammonium phosphomolybdate is considered not to be absolutely necessary for reliable results. These modifications are deemed to be of some importance in view of the scarcity and high price of the chemicals necessary in these operations.

A colorimetric method for the determination of the CO_2 percentage in air, H. L. HIGGINS and W. McK. MARRIOTT (*Jour. Amer. Chem. Soc., 39 (1917), No. 1, pp. 68–71*).—A method which depends on determining the reaction of a solution of sodium bicarbonate after passage of air until the solution is saturated with carbon dioxid is described in detail. The reaction of such a solution will depend on the relative amounts of the alkaline bicarbonate and carbonic acid present. This in turn depends on the pressure of the carbon dioxid in the air with which the mixture has been saturated and is independent of the volume of air passed through the liquid. High pressures of carbon dioxid change the reaction of the solution toward the acid side, while low pressures have the reverse effect.

The indicator used is phenolsulphonephthalein and the standards, acid potassium phosphate (KH_2PO_4) and alkaline sodium phosphate (Na_2HPO_4).

The method is not applicable in the presence of acid or ammonia fumes.

On the determination of small amounts of arsenic with special reference to the procedure according to Smith, K. BECK and MERRES (*Arb. K. Gsndhtsamt., 50 (1915), No. 1, pp. 38–49, pls. 2, figs. 2*).—This is a general review and discussion of the methods proposed for the determination of minute quantities of arsenic.

The method described by Smith (E. S. R., 28, p. 24) is deemed very satisfactory and to yield very accurate results, especially in the examination of foods and food products. The procedure is easy to manipulate and requires a minimum of time and only a very small sample, this being an especially great advantage with organic material.

It is indicated that the simple colorimetric method is accurate for differentiating amounts of arsenic of 0.002, 0.005, 0.01, 0.02, 0.03, and 0.04 mg. For greater accuracy the procedure should be used only as an indicator, the ultimate determination being made either gravimetrically or titrametrically, preferably the latter.

Some analytical data of the arsenic determined in various meat, plant, and yeast extracts, caviar, hydrogenated oils, and gelatin are submitted.

A new procedure for the determination of methyl alcohol in the presence of ethyl alcohol, G. REIF (*Arb. K. Gsndhtsamt., 50 (1915), No. 1, pp. 50–56*).—A procedure which depends on the formation of trimethylsulphiniodid and subsequent titration with silver nitrate and retitration with ammonium thiocyanate is described in detail, as well as a slightly modified procedure for determining methyl alcohol in brandy in which the acids, esters, aldehydes, and acetone usually present do not interfere. Analytical data submitted indicate the accuracy of the procedure.

The determination of raffinose in the presence of sucrose by means of double inversion with two special yeasts, H. PELLET (*Bul. Assoc. Chim. Sucr. et Distill., 33 (1916), No. 10–12, pp. 255–262*).—The unreliability of the usual procedure of polarization before and after inversion with acid in the

presence of appreciable amounts of nitrogenous reducing substances (glutamin and asparagin) is pointed out. The newer methods of inversion by double fermentation with "top" and "bottom" yeast are considered to yield excellent results and to be entirely reliable. Some analytical data are submitted.

The estimation of pentose or pentosans by means of Fehling's solution, J. L. BAKER and H. F. E. HULTON (*Analyst, 41 (1916), No. 487, pp. 294–297*).—The authors have used the method of Flohil as improved by Eynon and Lane (E. S. R., 27, p. 113), and indicate as decided improvements in the procedure the use of a much larger volume of Fehling's solution, in order that a considerably larger fraction of the total distillate may be treated, thus increasing the weight of CuO obtained, and, instead of boiling the solution, heating by immersion in a boiling water bath.

The values for the CuO equivalent of pure furfural found by Eynon and Lane were confirmed. The figures for the CuO yielded from 20 cc. of Fehling's solution with sodium chlorid alone were not in agreement. This discrepancy in results, as well as the procedure in general, is briefly discussed.

Determination of sugar in hay and turnips, R. K. KRISTENSEN (*Tidsskr. Planteavl, 23 (1916), No. 2, pp. 233–250*).—Detailed tabular analytical data of the sugar content of hay and turnips are submitted. From the data it is concluded that the use of lead acetate with Fehling's solution for the determination of sugar introduces errors in the results.

Control analyses were made with a solution of pure sucrose.

The determination of fat in cacao products, W. LANGE (*Arb. K. Gsndhtsamt., 50 (1915), No. 1, pp. 149–157, fig. 1*).—The author discusses the incomplete extraction of cacao fat obtained with a Soxhlet apparatus, and describes a new procedure for the determination. The procedure consists of extracting the sample on a Witte plate with an asbestos filter by suction with small portions of ether. The ether is then evaporated and the fat weighed in the usual manner. The procedure requires considerably less time than the older method of extraction and is deemed to be as satisfactory in every respect.

Some experimental data are submitted.

The alcohol test in milk, I. M. KOLTHOFF (*Pharm. Weekbl., 53 (1916), No. 47, pp. 1589–1600*).—The alcohol test in milk is considered to depend on the calcium ions present. In normal milk the alcohol test (with 70 per cent alcohol) appears when the acidity is equivalent to 7.8. In abnormal milk there is no relation between the alcohol test and the acidity, but the test also appears here with a comparatively low acidity.

For the practical examination of milk, as well as from a hygienic and pathological-chemical standpoint, the test is considered to be of great importance. If no flocculation appears the double test (using twice the amount of alcohol) should be used. Flocculation in a sample of normal acidity probably indicates an abnormal milk. As a check on the result the catalase index and leucocyte content should be determined.

The detection of added water in milk, H. DURAND (*Jour. Indus. and Engin. Chem., 9 (1917), No. 1, pp. 44, 45*).—This is a brief review of the methods which have been proposed for determining added water, namely, by the refractive index of the serum, the freezing point of the whole milk, and the specific gravity of the whole milk and serum. Some experimental data on the freezing point method are included and discussed.

The action of various animal charcoals on pure and impure sugar solutions and their influence in the analysis of sugar refinery products, H. PELLET (*Bul. Assoc. Chim. Sucr. et Distill., 33 (1916), No. 10–12, pp. 220–227*).—The results of experiments in which a number of charcoals were used in the

analysis of sugar products show that different samples vary greatly in density and composition. A great variation in their decolorizing power was also observed. A variable amount of sugar was absorbed by the samples, the absorption being much less in the presence of lead. In a solution of molasses defecated with lead subacetate there was no appreciable absorption of sugar. In a complete analysis of a molasses solution some samples of charcoal gave slightly low results, while others did not appreciably affect the results. Special decolorizing charcoals were found not to absorb the reducing substances in beet or cane-sugar molasses, but did absorb some nonfermentable, polarizable material in the cane molasses.

The experimental data are submitted in tabular form.

The occurrence and determination of citric acid in wine, F. WOHACK (*Ztschr. Landw. Versuchsw. Österr., 19 (1916), No. 2, pp. 53–56*).—The author considers that citric acid may occur as a normal constituent in wine.

Of the methods proposed for the determination of citric acid the procedure of Kunz[1] is considered to be the most reliable.

The identification and estimation of lactic acid in biological products.—First paper, I. K. PHELPS and H. E. PALMER (*Jour. Amer. Chem. Soc., 39 (1917), No. 1, pp. 136–149, fig. 1*).—Experimental data are submitted which show that lactic acid may be estimated as the guanidin salt and identified by its melting point after separation by esterification from citric and tartaric acids and by fractional distillation from formic and acetic acids. It may be separated from mixtures containing formic, acetic, propionic, butyric, and citric acids and accurately estimated by weighing as quinin lactate, which may be identified by its melting point.

"The separation from citric acid and other acids whose ethyl esters also have high boiling points is effected by esterification with the vapor of alcohol containing dry hydrochloric acid gas in solution, passed through the mixture suspended in vaselin at a temperature of 100 to 110° [C.], using zinc chlorid as a second catalyzer; the ethyl lactate passes quantitatively into the distillate, while the ethyl citrate remains in the flask. By fractional distillation of the distillate through a Hempel fractionating column filled with glass beads the ethyl formate and ethyl acetate, together with a large part of the ethyl propionate and ethyl butyrate, are removed. The residue in the flask, containing the ethyl lactate, is hydrolyzed and converted to the quinin salts, and the quinin lactate is separated from the propionate and butyrate by the solubility of the quinin salts of the latter in carbon tetrachlorid. The quinin lactate may then be weighed and identified by its melting point."

Rate of turbidity in beverages containing maltose, glucose, or maltose and glucose, A. W. HOMBERGER and C. S. MARVEL (*Jour. Amer. Chem. Soc., 39 (1917), No. 1, pp. 156–162*).—From the study reported it is concluded that turbidity may occur in solutions containing glucose without the presence of albuminous or mineral constituents. The turbidity is due to germination of the spores of the mold *Penicillium glaucum* in the glucose medium. The presence of alcohol and carbon dioxid has no appreciable effect on the appearance of the turbidity in glucose solutions. Maltose does not act as a chemical stimulus on the spores and hence maltose solutions do not become turbid on standing.

The concentration of lime juice by freezing (*Imp. Dept. Agr. West Indies, Rpt. Agr. Dept. Dominica, 1915–16, pp. 33–36*).—Following the procedure outlined by Gore (E. S. R., 33, p. 209), experiments are reported from which it is concluded that raw lime juice can be concentrated by freezing and centrifugalization without affecting its properties as a beverage. By one treatment the acid

[1] Ztschr. Untersuch. Nahr. u. Genussmtl., 2 (1899), No. 9, pp. 692–694.

content of the juice may be increased from about 13 oz. to over 20 oz. per gallon. If this concentrated juice be again treated a juice containing 30 oz. per gallon can be obtained. The low testing juices can be converted into calcium citrate, thus eliminating all losses. The economic importance of the process with respect to package and transportation charges is indicated.

The utilization of olive pomace, W. V. Cruess and A. W. Christie (*Jour. Indus. and Engin. Chem., 9 (1917), No. 1, pp. 45–47*).—The authors at the California Experiment Station have found from 7.89 to 20.23 per cent of oil in fresh pomace (equivalent to from 20.98 to 53.81 gal. per ton). The most satisfactory solvent for the recovery of the oil from the air-dried pomace was found to be gasoline, and four extractions were sufficient. The air-dried pomace of lowest oil content was found to yield 25.5 gal. of oil per ton by gasoline extraction. The composition of the oils extracted with gasoline, benzol, and ligroin compared favorably with that of pure olive oil in regard to their value for soap making. Distillation by direct heat was found to be the most satisfactory procedure in the recovery of the solvent. It is indicated that "no commercial value as fertilizer should be assigned to olive pomace, either before or after extraction."

The utilization of Imperata cylindrica P. B. in the paper industry, F. Vignolo-Lutati (*Ann. R. Accad. Agr. Torino, 58 (1915), pp. 69–76*).—Results of the study reported show that the grass *I. cylindrica* yields a very satisfactory cellulose fiber, about 38 per cent of the raw material being converted into bleached fiber. In the use of the stock a smaller quantity is necessary for the production of the finished product than with some other grasses.

The removal of barium from brines used in the manufacture of salt, W. W. Skinner and W. F. Baughman (*Jour. Indus. and Engin. Chem., 9 (1917), No. 1, pp. 18–26, fig. 1*).

The theory of drying and its application to the new humidity-regulated and recirculating dry kiln, H. D. Tiemann (*U. S. Dept. Agr. Bul. 509 (1917), pp. 28, figs. 3*).—This discusses the subject with special reference to the drying of lumber, under the topics of elementary principles of drying, elementary principles of hygrometry, types of kilns, drying by superheated steam, importance of proper piling of lumber, theory and description of the U. S. Forest Service kiln, theoretical discussion of evaporation, theoretical analysis of heat quantities, and increase in density produced by evaporation.

METEOROLOGY.

A preliminary study of climatic conditions in Maryland, as related to plant growth, F. T. McLean (*Physiol. Researches, 2 (1917), No. 4, pp. 129–208, figs. 14*).—This is a detailed account of studies briefly and partly reported upon elsewhere (E. S. R., 33, p. 116). Observations on the growth of soy bean seedlings on the same soil uniformly supplied with moisture at Easton, on the Eastern Shore of Maryland, and at Oakland, in the mountains of western Maryland, are reported and discussed.

Plantings were made in plunged pots every two weeks during the growing season and the plants were allowed to grow for a month. The soil was kept uniformly moist by means of autoirrigators. Evaporation was measured by means of standardized cylindrical porous-cup atmometers. Daily, maximum, and minimum temperatures were observed in the usual manner and account was also taken of sunshine records, rainfall, and soil moisture. After two weeks' growth measurements were made of "stem height, average number of leaves per plant, average length and width of mature leaves, and average of the products obtained by multiplying length by width for each leaf. After

about a month of growth these measurements were repeated and, also, the average leaf area and the average dry weight of tops per plant were determined."

It was found that the conditions at Easton were more favorable for the growth of soy-bean plants than those at Oakland. "The total efficiency of the Easton frostless season for 1914, measured in terms of leaf-product as here used, was about 2.5 times as great as that of the Oakland frostless season." Stem height, leaf surface, and dry weight furnished the best means of comparison of the growth rates of the experimental plants. "The rates of growth in stem height were generally more rapid during the first than during the second fortnight of growth from the seed, for both stations. On the other hand, the rates of increase in leaf area (as approximately measured by means of the leaf-product) were generally more rapid during the second fortnight."

The growth rates generally showed very evident seasonal marches which were most clearly shown by the rate of increase in stem height and corresponded in general trend to the seasonal marches of the temperature conditions. "The seasonal marches of both the growth rates and the temperature values for Oakland are quite markedly different from those for Easton. Both ranges are greater for Easton than for Oakland. The highest temperature values and the highest growth rates occurred at Easton, and the growing season was terminated by killing frost earlier at Oakland than at Easton. Nevertheless, the last two-week period before autumn frost at Oakland exhibited a higher temperature value and higher growth rates than did the last two-week period before frost at Easton.

"This difference between the magnitudes of the final minimum growth rates observed at the two stations appears to emphasize one of the main differences between a mild, equable, coastal climate and a much more rigorous mountain climate, as these may influence plant growth. In the milder climate of Easton, with its small daily range of temperature, the frostless season is apt to be prolonged until the growth of many plants is much reduced or entirely checked by low temperature. In the mountain climate of Oakland, however, with its large daily range of temperature and high nocturnal radiation, very low night temperatures and frosts occur earlier in the season, while the day temperatures and the growth rates of many plants are still high. These differences between the two stations, as regards the temperatures and growth rates exhibited at the close of the season (just before autumn frost), are surely intimately associated with the two types of climate here illustrated, and are of undoubted importance in the consideration of plant life in general.

"Another difference to be noted between the two stations here considered refers to the time of occurrence, within the growing season, of the maxima of temperature and of growth rates. These maxima occurred about a month earlier at Oakland than at Easton—a fact that may be of significance in the comparative seasonal climatology of these stations, at least for the summer of 1914. . . .

"It appears that temperature was clearly the limiting condition (in the usual sense) for growth during the first two weeks, in practically all cases. During the second two weeks of growth, however, with exactly the same environmental conditions, the moisture relation (rainfall-evaporation ratio) appears in many cases to have been the limiting condition for growth, this being especially true . . . when the temperature was high. It thus appears that if two plants in different stages or phases of their development are exposed to the same fluctuations in environmental conditions, the limiting condition for one plant during a succeeding period may be of an entirely different nature from that for the

other. This must be due to a difference between the internal conditions of the plants at different developmental stages."

As a test of the methods employed the results indicated that many of the new methods proposed for work of this kind "are of value, and the data obtained by their means throw light upon the question of the influence and relative importance of several different climatic features, as these affected the growth of the culture plants." They indicated that culture plants may be successfully used as integrating instruments for the measurement of climate, that the autoirrigator furnishes a satisfactory means for soil moisture control, and that the standardized cylindrical porous-cup atmometer, taken with the ordinary precipitation records, gives a ratio of rainfall to evaporation that appears to be a very valuable measure of moisture conditions. Sunshine records obtained by the Marvin sunshine recorder were also found to be of some value.

Weather forecasting, G. S. BLISS (*U. S. Dept. Agr., Weather Bur. Bul. 42, 2. ed. (1917), pp. 37, figs. 4*).—In this second edition (E. S. R., 29, p. 120), "the style and subject matter have been alternated slightly to conform more closely to the uses to which the pamphlet has been put. The errors that crept into the first edition have been eliminated so far as possible, thus bringing it up to date and in accordance with our present knowledge of the subject."

Weather observations, A. J. FARLEY (*New Jersey Stas. Rpt. 1915, pp. 65, 66*).—Observations on temperature and precipitation at New Brunswick during 1915 are summarized. The maximum temperature, 92° F., was recorded July 31; the minimum, 2°, December 27. The total annual rainfall was 50.03 in., 1.31 in. above the normal.

[British rainfall in 1916], H. R. MILL (*Times [London], 1917, Jan. 25; rev. in Nature [London], 98 (1917), No. 2466, p. 435*).—Detailed results are given for 131 stations. These show that 1916 was generally a wet year in the British Isles, the rainfall being far in excess of the average at most stations and slightly below at a few. A deficiency of rainfall occurred in the extreme southwest of Wales and the northwest of Devon and Cornwall, and in two areas in the center of England. The area over which the year was relatively dry was much less than in any other of the last 12 years except 1912.

"The excess of rain was most pronounced in the south of England, the center of Scotland, and the southwest, northwest, and east of Ireland. The wettest part of England was in the district of East Grinstead, where the excess was about 40 per cent. In Scotland the excess of rainfall was 20 per cent over nearly one-half of the country, while in parts there was an excess of more than 40 per cent. The whole of Ireland was wet; the greatest excess of more than 30 per cent stretched inland from Dublin Bay. No year since 1903 has been wetter than last year in Scotland and Ireland, while the British Isles as a whole have only been wetter than 1916, during the last 50 years, in 1903, 1882, 1877, and 1872."

Results of rainfall observations in New South Wales, 1909–1914, H. A. HUNT ET AL. (*Melbourne: Govt., 1916, pp. 224, pls. 14, fig. 1*).—This is a continuation of a report published in 1909 bringing the rainfall history of New South Wales up to the end of 1914.

"The work, in addition to the general notes, includes tabular statements of rainfall at some 2,100 stations for the years 1909 to 1914, inclusive, and the annual averages computed from the commencement of the period over which the records extend; also rainfall notes and maps for each of the foregoing years; a statement and graphs showing the state of the rivers since the last report; a very carefully prepared table showing the yearly rainfall averages derived from selected stations in each of the divisions of the State, also the

State itself, and an explanatory graph of weighted results as far back as records available would permit; tables giving the monthly rain records at 167 specially selected stations with monthly and annual averages; also maps indicating the prevalence of frosts, hail, and rain during the wheat period, namely, April to October; and, finally, as an appendix, the results of meteorological observations taken at the Sydney observatory since 1840."

Summarizing the records of each district of New South Wales for a period of 44 years, 1871 to 1914, inclusive, it is shown that the average district rainfall varied from 11.44 in. in the southern portion of the western division to 50.2 in. in the north coast division, the former comprising about one-seventh of the whole area of the State. "As the country extends in an easterly and northeasterly direction the rainfall becomes greater, and finally reaches its highest district fall in the neighborhood of the north coast."

SOILS—FERTILIZERS.

Analyses of soils of Jones County, W. A. Worsham, Jr., L. M. Carter, D. D. Long and M. W. Lowry (*Bul. Ga. State Col. Agr., No. 93 (1916), pp. 47, figs. 2*).—This is a report of chemical analyses of the soils of the county to supplement the physical survey of the soils made in cooperation with the Bureau of Soils of the U. S. Department of Agriculture (E. S. R., 32, p. 513).

"Taking the average of all the soils of the county, the analyses show the plant food content to be as follows: Nitrogen 0.0265, phosphoric acid 0.0377, and potash 0.639 per cent." It is stated that while the soils of the county show a rather wide variation in plant food content, the nitrogen content is uniformly low in practically all of them and is the limiting factor of crop production.

Soil survey of White County, Indiana, T. M. Bushnell and C. P. Erni (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 43, fig. 1, map 1*).—This survey, made in cooperation with the Indiana State Department of Geology, deals with the soils of an area of 324,480 acres in northwestern Indiana, the topography of which is generally that of a level to gently undulating plain.

"The northern half of the county is an old lake plain characterized by black, formerly marshy, sandy lands and light sand ridges. The southern half is a glacial plain with low moraines, and includes both timbered and prairie lands. The county is now completely drained by systems of dredged and scraped ditches and by tiles."

Including muck, 17 soil types of eight series are mapped, of which the Brookston silt loam, Clyde fine sandy loam, Plainfield fine sand, and Clyde silty clay loam cover 19.8, 16.9, 14.2, and 10.6 per cent of the area, respectively.

Soil survey of Newton County, Missouri, A. T. Sweet, E. S. Vanatta, and E. W. Knobel (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 41, pls. 3, figs. 2, map 1*).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 398,080 acres in southwestern Missouri. "Approximately one-third of the county consists of almost level to gently rolling uplands, a considerable proportion is embraced in stream flood plains and terraces, and the remainder includes gently rolling to rough, hilly land."

The soils of the county are of residual and alluvial origin. Twelve soil types of 10 series are mapped, of which the Baxter gravelly loam, Lebanon silt loam, and Gerald silt loam cover 34.3, 19.3, and 10.9 per cent of the area, respectively.

Soil survey of Alleghany County, North Carolina, R. T. A. Burke and H. D. Lambert (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 26, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 133,760 acres in northwestern North Carolina which lies in the Appalachian Mountain and Plateau province. Mountainous topography prevails, but there are many rounded elevations of generally smooth surface. There is said to be little undrained land in the county.

The soils are of residual and alluvial origin. Including rough, stony land and rock outcrop, eight soil types of five series are mapped, of which the Ashe loam and Porters loam cover 51.4 and 25.3 per cent of the area, respectively.

Soil survey of Hampton County, South Carolina, M. W. Beck and A. L. Goodman (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 37, fig. 1, map 1*).—This survey deals with the soils of an area of 392,320 acres in southern South Carolina which lies wholly within the Coastal Plain province. The topography ranges from flat to gently rolling and rolling. Regional drainage is not well developed. The soils range in texture from coarse sand to clay. Including swamp, 21 soil types of 10 series are mapped, of which the Norfolk fine sandy loam and the Coxville fine sandy loam cover 13.6 and 11.3 per cent of the area, respectively. The Norfolk series covers about 40 per cent of the area.

[Soil studies at the Wisconsin Station] (*Wisconsin Sta. Bul. 275 (1917), pp. 18–24, figs. 2*).—Experimental work at the station on the management of different Wisconsin soils, soil drainage, and soil acidity is briefly reviewed.

[Soils], P. S. Burgess (*Rpt. Expt. Sta. Com., Hawaii. Sugar Planters' Assoc., 1916, p. 13*).—Studies of old and new Hawaiian cane soils to determine the effect of continued cane culture on the chemical composition of the soil showed that "the older fields contain more readily available but less total plant food than the new lands. About 20 per cent of the total nitrogen and nearly 40 per cent of the total phosphoric acid have disappeared from the surface soils of the fields which have been cropped. . . . The bacterial activity in these soils was pronounced. Nitrification was better in the older fields. Gypsum and reverted phosphate stimulated nitrification but slightly."

Studies of acid soils of Hawaii showed that "ammonification is universally low and that nitrification, though slightly better, is also low. The addition of gypsum and reverted phosphate at the rate of 2 tons per acre increased the nitrification of dried blood by over 50 per cent. When just sufficient lime carbonate was added to neutralize exactly the soil acidity the ammonification and nitrification of dried blood was in many cases more than doubled, while in two instances this beneficial bacterial action was increased tenfold or more."

Combinations of soils in plain and mountainous regions, S. S. Neustruev (Néoustroueff) (*Pochvovîedîenïe (Pédologie), 17 (1915), Nos. 1, pp. 62–73; 2, pp. 51–59*).—This is a classification of soils with reference to topography and climate. It is pointed out that the soils are influenced by the climatic zone regardless of the relief in the zone.

Separation of oxids of iron and aluminum in sandy and pebbly soils of Finland, B. Aarnio (*Pochvovîedîenïe (Pédologie), 17 (1915), No. 3, pp. 1–23*).—This article deals with the formation of ortsand and ortstein and related combinations and gives tables of analyses of samples of these materials from Hannover, Holstein, Pomerania, and Finland.

Ferrification in soils, P. E. Brown and G. E. Corson (*Soil Sci., 2 (1916), No. 6, pp. 549–573, figs. 8*).—The literature of the subject is reviewed and tests

of methods of determining iron in soil and of the ferrifying power of soils are reported. The conclusions reached are as follows:

"Ferrification and deferrification are processes common to the soils used in this study. The degree of ferrification and deferrification may depend upon many factors, such as organic matter content of the soil, cultivation, moisture, temperature, and food supply. An incubation period of one week in solutions is not sufficient time to allow the organisms to develop and bring about ferrification. There is no relation between the organic matter content of the soil and its ferrifying power when solutions are used. The cultivated soil has the greatest ferrifying power. Sterile water to which is added 0.1 gm. of ferrous carbonate is the best medium for the growth of the bacteria causing ferrification in solutions.

"Sand, with the addition of 0.1 gm. of ferrous carbonate and maintained at an optimum moisture content with distilled water, represents more nearly the conditions of moisture, temperature, and aeration in the field than do the solutions. When sand is used as a medium for the growth of the bacteria, it appears that the ferrifying power of the soil is related to its organic matter content. Where there was a high percentage of organic matter, there was a corresponding increase in ferrification. When the soil was low in organic matter, deferrification took place.

"The use of pure cultures of bacteria indicates that the common soil organisms, as well as the iron bacteria, are able to bring about ferrification. Molds as well as bacteria are capable of oxidizing ferrous iron."

A list of 16 references to the literature of the subject is given.

Contributions to our knowledge of soil fertility.—XII–XIV, R. Greig-Smith (*Proc. Linn. Soc. N. S. Wales, 39 (1914), pt. 4, Nos. 156, pp. 839–850; 160, pp. 631–645, 724–733*).—Three studies are reported.

In the first paper the action of toluene on protozoa in different soils is taken up. With a poor alluvial soil in moist condition it was found that the ciliates survived a treatment of 1.5 per cent toluene and were killed by 2 per cent, while amœbæ survived a 2 per cent treatment. In the air-dried soil the ciliates and amœbæ survived a 20 per cent treatment. With a sandy soil in moist condition ciliates survived 1 per cent and were killed by 2 per cent toluene, and amœbæ survived 2 per cent but were killed by 5 per cent. In the air-dried soil both ciliates and amœbæ again survived 20 per cent toluene.

The theory that certain bacteria may have an influence upon the development of the fauna in treated soils was not substantiated. It was further found that "if the conditions are such that a reduction of sulphate is possible, as, for example, in soils containing much organic matter, there is the possibility that the action of a volatile disinfectant, by destroying some of the groups of the sulphur-oxidizing bacteria, may indirectly affect the growth of the protozoa, and especially of the ciliates."

In further tests of air-dry soils, "treatment with varying quantities of toluene showed that all percentages up to 20 failed to destroy the protozoa, taking *Colpoda cucullus* as being typical of the ciliates, Cercomonas or Trepomonas as representing the flagellates, and the usual *Amœba limax* or *lobosa* for the amœbæ. . . . The experiments show that there is considerable irregularity either in the effect of the disinfectant or in the capability of growth after treatment. It appears that toluene has little disinfecting action when the moisture content is lower than from one-tenth to one-twentieth of the water-holding capacity of the soil and that when soils are quite moist amœbæ and flagellates may not be affected to any great extent. . . . It appears to make no difference whether the water is originally present in the soil or is added at the time of toluening. . . . Omitting the flagellates, which appear irregular, the

action of heat upon the protozoa is very similar to the action of the volatile disinfectants. . . .

"Regarding the action of toluene upon the bacteria, there is indicated, in the formation of the sulphid, the probability that certain oxidizing organisms in the wet soils are, by the treatment, either destroyed or overwhelmed in numbers by the surviving reducing bacteria. In dry soil this does not occur. Conditions which cause the apparent destruction of the sulphur-oxidizing bacteria also cause the destruction of the ciliates."

In the second paper, experiments with garden soil are reported, from the results of which it is concluded that "the formation of toxins in the soil free from vegetation occurs most rapidly when the temperature is near 28° C. and the moisture content is one-fourth of the water-holding capacity. The soil extract is, as a rule, either nutritive or toxic according to the volume of water, relative to the soil, used in preparing the extract. It is most nutritive when the ratio of soil to water is 1 : 0.5, and most toxic when it is 1 : 1.

"A previous drying or chloroforming of the soil generally causes the extract to be much more nutritive than when the raw soil is used. The addition of small quantities of dextrose to soil brings about a more rapid production of toxin, while aeration of the treated soil accelerates the formation and decay of the toxin."

Experiments are reported in the third paper in which it was found that chloroform acts as a stimulant in soil extracts. It is considered justifiable to conclude that chloroform will act in the same manner in soil moisture. "Its persistence in the soil after treatment, combined with its action in soil extracts, argues in favor of the stimulation theory that the great increase in the bacterial numbers, following treatment of a soil with chloroform, is due in part to the stimulation of the bacteria by small doses of the disinfectant retained by the soil."

The organic matter of the soil.—II, A study of carbon and nitrogen in seventeen successive extracts; with some observations on the nature of the black pigment of the soil, R. A. Gortner (*Soil Sci., 2 (1916), No. 6, pp. 539–548, fig. 1*).—Supplementing a previous paper of this series (E. S. R., 36, p. 512), an account is given of a further study of the hydrochloric acid and sodium hydroxid extracts of a silt loam soil. Examinations of these extracts as well as of the residual soil at different stages of the extraction confirmed the author's previous conclusion that 4 per cent sodium hydroxid solution does not dissolve the black soil pigment. This pigment was found to be soluble in very dilute sodium hydroxid solutions, but precipitates from solution on the addition of sodium hydroxid in sufficient amount to make a 4 per cent solution.

"The soil pigment is also precipitated from solution by salts of the heavy metals and by acidification, is not dialyzable, and forms a stable water-soluble compound with ammonia when an ammoniacal solution is evaporated to dryness. Two attempts were made to prepare the soil pigment in pure form, but the resulting products contained such a high content of ash (37.47 per cent and 51.17 per cent, respectively) as probably to render the ultimate analysis unreliable. The analysis of the product with the least ash content gave carbon 61.3 per cent; hydrogen 4.3 per cent; nitrogen 2.8 per cent; oxygen 31.6 per cent; all calculated to an ash-free basis. The first six extractions with NaOH removed relatively more nitrogen than carbon from the soil, but the remaining three NaOH extractions as well as the six pigment solutions contained relatively more carbon than nitrogen. The final soil residue had a carbon-nitrogen ratio very much higher than that of the original soil."

References to the more important literature on the subject are given.

The influence of various cations upon the rate of absorption of ammonium ion by soil, K. MIYAKE (*Soil Sci., 2 (1916), No. 6, pp. 583–588*).—From a study of the mechanism of absorption of the ammonium ion by a loam soil, the author draws the following conclusions:

"The relation between the time which a solution of ammonium chlorid has remained in contact with soil and the amount of ammonia absorbed by the soil is expressed by the equation $x=Kt^m$ even in the presence of another chlorid in solution. The presence of other chlorids decreases the rate of absorption of ammonia from ammonium chlorid solution by the soil. The retardation increases with the concentration of salt employed. Salts differ in their power of causing retardation of the rate of absorption of ammonia. The retarding effect of the salts employed increases in the following order: $Na<Mg<Ca<Al<K$. The value of Km, which we term the coefficient of absorption in this case, decreases with increasing concentrations of the salts, the acceleration of the decrease being positive in the cases of $NaCl$, $MgCl_2$, and $CaCl_2$, and negative in the cases of $AlCl_3$ and KCl."

A list of references to literature bearing on the subject is given.

Effect of irrigation water and manure on the nitrates and total soluble salts of the soil, F. S. HARRIS and N. I. BUTT (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 9, pp. 333–359, figs. 18*).—Experiments were conducted at the Utah Experiment Station to determine the effect of varying quantities of soil moisture and manure on the total soluble salts and nitrates that can be extracted by water from soil kept in the laboratory, soil kept for long periods in large tanks, and normal field soil. Comparisons were also made of cropped with uncropped soils in tanks and in the field.

It was found that "with a sod soil held in the laboratory for 2.5 years, the total salts and nitrates accumulated most rapidly with a moisture content between 23 and 28 per cent. Cropped and uncropped soil kept in large tanks under controlled moisture conditions showed a decrease in nitrates and total soluble salts as the percentage of moisture increased, the nitrates being particularly low in water-logged soil. Under field conditions more nitrates were found in both cropped and fallow soils during the summer than just after the corn crop was harvested.

"The nitrates of the fallow field soils averaged higher with a manuring of either 5 or 15 tons to the acre than with no manure, but on the cropped soil, although the 15-ton application of manure resulted in more nitrates than no manure, the 5-ton did not. The fallow soil showed the effect of the manure on the nitrates more in the top 2 or 3 ft. than at lower depths.

"The highest soluble-salt content of fallow soil was on plats manured at the rate of 5 tons to the acre; the lowest was on plats receiving 15 tons. The corresponding high and low points in cropped soil were on plats receiving no manure and 5 tons to the acre, respectively.

"Unirrigated land contained more nitrates than irrigated on both cropped and uncropped plats. Increasing the irrigation water applied to the soil decreased its nitrate content. The total soluble salts in cropped plats decreased as the water applied increased, and in fallow soil an application of 40 in. of water resulted in less salts than where no irrigation water was added. The treatment affected the salts more in the surface foot than at greater depths with small irrigations, but when 20 in. of water or more were applied some of the salts seemed to have moved below 10 ft. in depth. Large irrigations decreased the soluble salts in cropped more rapidly than it did in fallow soils.

"Manuring or irrigating the soil affected the nitrates relatively more than the total salts. In unmanured soil the nitrate content was about twice as great with a fallow as with a crop and in manured it was about three times as great.

"The ratio of total soluble salts to the quantity of sodium nitrate found in a cropped soil rose from 24.5:1 without irrigation to 37.5:1 when 40 in. of water were used. The ratio in fallow soil increased from 8.9:1 with no irrigation water to 16.2:1 with 40 in.

"The field results do not indicate a close relationship between the crop yield and the total soluble-salt or the nitrate content of the soil if the differences between cropped and fallow soils indicate the amounts of these substances which the crop used."

It is considered evident from these results "that the soluble salts and especially the nitrates are found in lower concentrations in soils receiving large quantities of irrigation water than in those receiving less water."

Seventeen references to literature bearing on the subject are appended.

The influence of bacteria in manure on the decomposition of green manure (legume and nonlegume), J. G. Lipman and A. W. Blair (*New Jersey Stas. Rpt. 1915, pp. 223–229, pl. 1*).—This is an account of a continuation of experiments previously described (E. S. R., 34, p. 129), in which cow manure was used.

It was found that manure has "an influence aside from any effect which may be attributed to fertilizing constituents which it contains. While there is not positive proof that this beneficial effect is due to the more thorough decomposition of organic matter by bacteria introduction in the manure, such a conclusion seems fairly warranted. Without exception the yields of grain and nitrogen were greater on the legume section than on the nonlegume section."

Farm manures, R. B. Dustman (*W. Va. Col. Agr. Ext. Dept. Circ. 97 (1916), pp. 16, figs. 4*).—This is a circular of popular information on the proper conservation and use of farm manures, based on a summary of experimental evidence obtained from a number of the State experiment stations.

Report on the fertilizer industry, August 19, 1916 (*U. S. Fed. Trade Com., Rpt. Fert. Indus., 1916, pp. XX+269, pls. 10*).—This report deals with the production and sale of various forms of nitrogenous fertilizers, phosphates, potash salts, and mixed fertilizers, and also with wholesale prices and farmers' prices of fertilizers. The figures on which the report is based do not, as a rule, cover a later period than the year 1914. It is estimated that the total value of fertilizers consumed in that year was in excess of $150,000,000. Of the approximately 7,500,000 tons of fertilizer consumed 6,750,000 tons, or 80 per cent, were mixed goods.

"Most of the fertilizers used in this country are purchased in mixed form and not in the form of materials. In the mixed fertilizer industry there are about 800 concerns operating some 1,200 plants, but the seven largest companies, with their numerous subsidiary and affiliated concerns, control more than 58 per cent of the total output. The two largest sell annually over a million tons each, and in the aggregate about 34 per cent of the total output." The combined statement of earnings and expenses of four large fertilizer companies for the period 1910 to 1914 "shows that while net sales increased 42 per cent, total expense increased 54 per cent and profits decreased 18 per cent. The increase in manufacturing cost and selling expense was about equal."

The report states "that the price movements of materials, except potash salts, are controlled fundamentally by conditions of supply and demand. The prices of nitrate of soda and sulphate of ammonia are considerably influenced by conditions in the European beet-sugar industry, while the prices of the organic ammoniates are affected largely by domestic crop conditions. Cottonseed meal prices usually follow the trend of corn prices and influence the course of prices of the other organic ammoniates—tankage, dried blood, and fish scrap. As a result of these factors the trend of prices of the inorganic and the organic nitrogenous materials show little relation to each other. The prices of nitrate of

soda and sulphate of ammonia have been high at times when the prices of tankage and cottonseed meal were low, and vice versa." The possibility of substituting one nitrogenous fertilizer for another has, however, tended to steady prices and to prevent control of prices by combinations.

"The prices of phosphate rock and acid phosphate—the principal phosphatic materials—are also determined largely by domestic conditions, among which may be mentioned the prices of cotton on the demand side and the tendency to overproduction of Florida phosphate rock and of sulphuric acid on the supply side, these two materials being the constituents of acid phosphate." "The wholesale prices of German potash salts have been arbitrarily controlled by a syndicate of producers, of which the Prussian Government is a member, competition in prices having been eliminated since 1910 by an imperial law." Supply and demand, in the main, control the prices of mixed fertilizers.

"Farmers' prices of fertilizer materials for cash purchases in carload quantities have compared favorably with wholesale prices, but farmers' credit prices have often been excessively high. . . . The prices paid by farmers for mixed fertilizers have been high in comparison with the cash value of the constituent elements, partly because of credit conditions and the expensive distributing methods of the large fertilizer companies. . . . An important feature of the fertilizer industry in recent years has been the rapid increase of local dry-mixing concerns, especially in the cotton-growing States, and the activities of concerns engaged in selling fertilizer materials and in spreading a propaganda for home mixing. The competition of these concerns has had an important effect on the mixed-fertilizer business."

Some observations on the present status of the subject of the availability of nitrogen in fertilizers, C. B. LIPMAN (*Jour. Indus. and Engin. Chem., 9 (1917), No. 2, pp. 189–191; Rpt. Chem. Control Com., Nat. Fert. Assoc., Meeting Fert. Div. Amer. Chem. Soc., 1916, pp. 3–6*).—This is a review of work conducted mainly at the California Experiment Station, the purpose being to bring out "that the nitrifiability of fertilizers as determined by some laboratory method is a reliable guide to the determination of their availability, that soils of different climatic regions differ markedly in that respect, and that the standards on the availability of nitrogen in different fertilizers as previously established under humid soil conditions will probably have to be revised for arid soils at least."

The availability of nitrogenous materials, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stas. Rpt. 1915, pp. 195–203, pls. 2*).—Pot experiments with barley on white sand confirmed the results of previous experiments (E. S. R., 34, p. 129) in that they showed the amount of nitrogen recovered from sodium nitrate, ammonium sulphate, and organic materials to be in the order in which the materials are named. In further experiments on sandy loam soil calcium cyanamid stood second to sodium nitrate in percentage of nitrogen recovered, but in yield of dry matter dried blood was second and ammonium sulphate third. Ammonium nitrate gave only a low yield.

Pot experiments with barley on sandy loam soil to determine the availability of ammonium sulphate when used in varying amounts with and without lime showed that the yield increased with the increase of the ammonium sulphate applied up to a certain limit. Limed and unlimed sections were very much alike, although more nitrogen was recovered from the limed than from the unlimed sections.

Experiments with white sand to compare green manures with commercial nitrogenous materials, showed that the largest yield of barley was obtained with sodium nitrate, followed in order by ammonium sulphate, dried blood, and tankage. The yields with alfalfa, vetch, and Canada field peas did not

differ greatly and stood between the tankage and dried blood. Of the nonlegumes, timothy stood ahead, but all were low, the yields with green wheat and rye being only a little more than the check. The percentages of nitrogen in the dry matter were fairly constant, the lowest being 0.85 per cent, and the highest 1.117 per cent. The highest recovery of nitrogen was 66 per cent with nitrate of soda. The ammonium sulphate, dried blood, and tankage followed in the order named. The highest recovery with the green legumes was 39 per cent, with Canada field peas, and the lowest 35.1 per cent, with alfalfa. The highest recovery with the nonlegumes was 19.3 per cent, with timothy, while both the others fell below 5 per cent.

"The results emphasize the desirability of the legumes as a green manure crop rather than the nonlegumes, for not only do the legumes furnish more nitrogen but that which they do furnish is far more available."

Further experiments on sandy loam soil showed that the percentages of nitrogen recovered were lower in all cases than in the first experiments. Nitrate of soda stood first with ammonium sulphate second. The recovery with Canada field peas was almost equal to the recovery from ammonium sulphate, while the recoveries from the blood, tankage, alfalfa, and vetch were somewhat lower but ran very close together. There was no recovery from rye and less than 1 per cent from wheat.

Nitrogen utilization in field and cylinder experiments: The influence of the mechanical composition of the soil on the availability of nitrate of soda and dried blood, J. G. Lipman and A. W. Blair (*New Jersey Stas. Rpt. 1915, pp. 213–223, pls. 4*).—This is an account of a continuation during 1915 of experiments begun in 1911 (E. S. R., 34, p. 130).

"For the first crop, the cylinders to which nitrate of soda and dried blood were applied invariably gave higher yields of dry matter than the check cylinders. Likewise nitrate of soda invariably gave a higher yield of dry matter and a higher recovery of nitrogen than dried blood. The percentage of nitrogen in the dry matter ran quite uniformly for the different treatments and throughout the different series. The average recovery of nitrogen from nitrate of soda for all series, first crops, was 54.89 per cent, and the average for dried blood 43.28 per cent. The highest recovery from nitrate was 64.09 per cent from cylinders containing 20 per cent of sand, and the highest from dried blood was 49.93 per cent from cylinders containing pure shale soil. Taking 100 as representing the availability of nitrate nitrogen, on the same basis the availability of dried blood nitrogen was 79.11.

"With the second or residual crop the average yield of dry matter with dried blood was somewhat greater than the average with nitrate of soda or the average on the check cylinders. The average on the check cylinders was almost as great as that from the nitrate cylinders. . . . In three out of the ten series there was no recovery of nitrogen from the nitrate cylinders, and in most cases the recoveries from the other seven were low. There was some recovery from dried blood for all series, the average being 6.32 per cent. In spite of the fact that the dried blood shows a higher recovery in the residual crop than nitrate of soda, when the combined recoveries are considered it is found that the nitrate stands first in all series except [one]. The average combined recovery for nitrate was 57.02 per cent and for dried blood 49.6 per cent. Again taking 100 as representing the availability of nitrate nitrogen for the combined crops, the availability of dried blood is represented by 86.36."

Lime as a factor in the utilization of nitrogen, J. G. Lipman and A. W. Blair (*New Jersey Stas. Rpt. 1915, pp. 204–213, pls. 2*).—Experiments on the influence of liming on the utilization of nitrogen in acid soils showed that "with an abundant supply of organic matter and carbonate of lime a crop is obtained

which is richer in protein and therefore higher in feeding value than one grown with a deficiency of these materials, even though the former be no more in quantity than the latter." The importance of carbonate of lime is further shown "in making available the nitrogen of the soil organic matter, and also in making conditions favorable for the accumulation of atmospheric nitrogen by means of leguminous crops."

Banana stalks as a source of potash, H. E. BILLINGS and A. W. CHRISTIE (*Jour. Indus. and Engin. Chem., 9 (1917), No. 2, pp. 153, 154*).—Analyses made at the California Experiment Station of dried banana stalks obtained from fruit markets showed that they contain as much potash as kainit and compare favorably with dried kelp as filler for commercial fertilizer. Charring and leaching of banana stalks yielded 27 lbs. of 90 per cent potassium carbonate per ton. The possibility of collection and treatment on a small scale is suggested.

Production of potash in 1916 (*U. S. Geol. Survey, Press Bul. 310 (1917), p. 1*).—It is estimated from nearly complete statistics collected by the U. S. Geological Survey that "the total production of potash salts and potash products in the United States in 1916 was close to 10,000 tons of potash (K_2O), with a net value at point of shipment of at least $3,500,000, figured at the prevailing selling prices." This is ten times the value of the production reported for 1915 and it is thought that the total for 1917 will be still greater. The production in short tons of available potash was as follows: Natural salts or brine 3,850, alunite and silicate rocks, including furnace dust recoveries, 1,900, kelp 1,110, ashes 220, and miscellaneous industrial wastes 1,750.

The largest output came from the Nebraska alkali lakes, but natural saline deposits elsewhere are beginning to make important contributions. It is stated that an organic source of high-grade potash similar to kelp "has been quietly developed, which has proved more productive."

Vegetation experiments: Comparison of basic slag with other phosphates, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stas. Rpt. 1915, pp. 229–234*).—This is an account of a continuation of experiments reported in 1913 (E. S. R., 32, p. 518) in which basic slag was compared with other phosphates.

The experiments "indicate a somewhat higher availability for the phosphoric acid of basic slags than has generally been assigned to such materials. If they are thus available for a single crop grown in quartz sand, there certainly seems good reason for believing that they would be even more available under normal field conditions."

The relative availability of acid phosphate and raw rock phosphate in Indiana field tests, S. D. CONNER (*Jour. Indus. and Engin. Chem., 9 (1917),* various crops made at the Purdue Experiment Station, in which acid phosphate and raw rock phosphate were compared, are reported. It was found that acid phosphate returned a crop increase over six times as profitable per acre and over seven times as profitable per dollar invested as that returned by raw rock phosphate.

"By calculating the phosphoric acid in all the crops grown, it is found that 224 lbs. of P_2O_5 have been recovered in the total increase caused by acid phosphate and 147 lbs. of P_2O_5 have been recovered in the total increase caused by raw rock phosphate. These amounts of P_2O_5 are approximately one-twelfth of the phosphoric acid applied in the acid phosphate and one eighty-fifth of the phosphoric acid applied in the raw rock phosphate."

Raw phosphate rock as a fertilizer, C. E. THORNE (*Ohio Sta. Bul. 305, pp. 227–277, figs. 8*).—This bulletin gives a review of work bearing on the subject reported from eight state experiment stations and from German sources, and gives a more extended report of experiments conducted at the Ohio Station

since 1897, the results of which, up to 1913, have been previously reported (E. S. R., 31, p. 217).

It is concluded "that raw phosphate rock may be used with profit on land that is materially deficient in available phosphorus, but as a rule acid phosphate has proved to be not only a more effective but also a more economical carrier of phosphorus to crops under conditions which render the freight charges a relatively large part of the cost of the fertilizer. Where a different outcome has resulted it is usually found that one or both of the phosphate carriers have been used in such large quantity as to furnish more available phosphorus than the crops were able to utilize, thus making a comparative measurement of the effect of the two carriers impossible."

Sulphur oxidation in soils and its effect on the availability of mineral phosphates, J. G. LIPMAN, H. C. MCLEAN, and H. C. LINT (*Soil Sci., 2 (1916), No. 6, pp. 499–538, figs. 5*).—The literature of investigations bearing on this subject is reviewed, and experiments in which sea sand, loam, and greenhouse soil were composted with manure, sulphur, and floats and analyzed periodically for acidity and available phosphoric acid are reported.

The results of the experiments show that in all cases considerable acidity was produced as a result of the oxidation of the sulphur, and the availability of the phosphoric acid of the floats was thus markedly increased. The process was most rapid in the case of the greenhouse soil, which was rich in nitrogen and mineral plant food as well as organic matter. The sulfofication increased with the period of incubation and with conditions favoring the activity of the sulfofying organisms. The data obtained indicate "that in compostng under farm conditions, one part of sulphur and two parts of floats may constitute a satisfactory combination for the production of available phosphoric acid."

A bibliography of 56 references to literature bearing on the subject is given.

The action of calcium carbonate on acid phosphate, E. W. MAGRUDER (*Jour. Indus. and Engin. Chem., 9 (1917), No. 2, pp. 155, 156*).—This article has been previously noted (E. S. R., 36, p. 325).

Value of the calcium phosphates in the vicinity of Monterey [Mexico], T. FLORES (*Mem. y Rev. Soc. Cient. "Antonio Alzate," 34 (1916), No. 10, pp. 351–362, pls. 6*).—This is a brief discussion of these phosphates.

Phosphates and phosphatic marls, L. HEIMBURGER (*Fla. Quart. Bul. Dept. Agr., 27 (1917), No. 1, pp. 175–177*).—Analyses of 12 samples of Florida phosphates and phosphatic marls are reported.

Limestone marls and shells, L. HEIMBURGER (*Fla. Quart. Bul. Dept. Agr., 27 (1917), No. 1, pp. 177–185*).—Analyses of 61 samples of Florida limestone marls and shells are reported.

Preliminary report on the marls and limestone of Mississippi, W. N. LOGAN (*Miss. Geol. Survey Bul. 13 (1916), pp. 82, figs. 11*).—This report discusses the limestones and marls of Mississippi by counties and gives analyses of samples from each county.

Agricultural lime analyses, H. J. PATTERSON and H. B. MCDONNELL (*Md. Agr. Col. Quart., No. 74 (1916), pp. 15*).—Actual and guarantied analyses of 129 samples of limes and limestone and mechanical analyses of 15 samples of ground limestone and oyster shells collected for inspection in Maryland from July, 1915, to October, 1916, inclusive, are reported together with general information on the kinds and use of agricultural lime.

Cost of crushing limestone on the farm, V. HERRON (*Ohio Sta. Bul. 303 (1916), p. 128*).—The total cost of crushing limestone with a portable limestone crusher at the Clermont County farm was found to be $2.40 per ton as against a purchase price for ground limestone, including freight and hauling, of $2.89 per ton.

Cost of ground limestone, C. W. MONTGOMERY (*Ohio Sta. Bul. 303 (1916), pp. 152, 153, fig. 1*).—At the Hamilton County experiment farm the total cost of crushing limestone was found to be $1.90 per ton as against a purchase price for ground limestone of $3.24, including freight and hauling.

Special fertilizer analyses, 1916, R. E. ROSE and F. T. WILSON (*Fla. Quart. Bul. Dept. Agr., 27 (1917), No. 1, pp. 63-81*).—Analyses of 224 special samples of fertilizers and fertilizing materials offered for sale in Florida during 1916 are reported.

Official fertilizer analyses, 1916, R. E. ROSE and F. T. WILSON (*Fla. Quart. Bul. Dept. Agr., 27 (1917), No. 1, pp. 82-103*).—Actual and guarantied analyses of 180 official samples of fertilizers and fertilizing materials collected for inspection in Florida during 1916 are reported.

Inspection of commercial fertilizers, 1916, H. D. HASKINS, L. S. WALKER, C. P. JONES, and W. A. ALLEN (*Massachusetts Sta. Control Ser. Bul. 6 (1916), pp. 93*).—This bulletin gives a list of fertilizer brands registered in Massachusetts in 1916, and reports the results of actual and guarantied analyses of 800 samples of fertilizers and fertilizing materials collected for inspection in the State during 1916. A summary is given showing average composition, cash price, and cost per pound, of each element of plant food, and special attention is called to commercial shortages and to the general character of the plant food contained in brands of mixed complete fertilizers and ammoniated superphosphates. Twenty-five per cent of the mixed complete fertilizers analyzed fell below the guaranty, over half of these being deficient in potash. On the average 51.7 per cent of the total nitrogen in the complete fertilizers was present as nitrates and ammoniates, while 48.3 per cent was present as organic nitrogen. Tests by means of the alkaline permanganate method gave additional proof of the low availability of some of the organic nitrogen.

A summary is also given of several hundred tests of the lime requirements of Massachusetts soils.

AGRICULTURAL BOTANY.

The physiology of cell division, G. HABERLANDT (*Sitzber. K. Preuss. Akad. Wiss., 1913, XVI, pp. 318-345, figs. 7; 1916, XLVI, pp. 1096-1111, figs 3*).—The work reported in these two articles was carried out first with sections from potato tubers, then with material from stems of other plants, and finally with leaf sections. It is said to have given increasing evidence that a stimulating substance is separated from the phloëm bundles, which, in connection with wound stimulus, causes or promotes cell division and growth in the tissues in the immediate neighborhood of the vascular bundles.

On the liquid pressure theory of the circulation of sap in plants, SARAH M. BAKER (*Abs. in Rpt. Brit. Assoc. Adv. Sci., 85 (1915), pp. 722, 723*).—The author, discussing two main current theories regarding the ascent of sap, proposes one based primarily upon the ecological evidence that high trees grow only where water vapor can have access to their roots.

It is stated that when either drought, low temperature, or an excess of liquid water decreases the vapor supply beyond a certain limit, trees disappear and the new plants which appear show marked xeromorphy. Experimental evidence is said to support the theory which assumes that the root hair zone is specialized for salt absorption and permeable to liquid water, likewise that the growing region of the root tip is impermeable to liquids but permeable to water vapor (hence called aeropermeable), this region also being concerned in the pumping efficiency of the root tip. Such an aeropermeable membrane, permitting liquids to pass in one direction but not in another, would render avail-

able the liquid pressure generated by a chemical reaction (respiration) which produces water at the expense of a gas, or by a physical change of state, producing water by the condensation of vapor. This latter mechanism, according to the theory here proposed, is responsible for root pressure. The condensation involves a direct conversion of energy, 90 per cent of the latent heat of vapor being theoretically convertible into liquid pressure. The ultimate source of energy is the combined action of capillary imbibition and solar heat on soil particles of different sizes, which produces a slight supersaturation in the soil interstices.

The second function of the root, the absorption of nutrient salts, is supposedly effected by alternate extrusion and absorption through the root hairs of an acidic solvent. It is further suggested that in plant circulation, the whole upward current is in the xylem and the downward movement in the phloëm, the medullary rays maintaining the continuity at all levels.

The cryoscopic constants of expressed vegetable saps as related to local environmental conditions in the Arizona deserts, J. A. Harris, J. V. Lawrence, and R. A. Gortner (*Physiol. Researches, 2 (1916), No. 1, pp. 49*).—The results of the studies here outlined are considered to show that concentration of the cell sap, in the plants characteristic of different habitats, shows a certain differentiation. The average values obtained are lowest for the arroyo or sandy wash, then successively higher for the canyons and foothills, the sandy slopes, the bajadas or mesalike slopes, and finally the salt spots. For the region as a whole, within working distance of Tucson, Ariz., the cryoscopic determinations show concentrations for trees and shrubs of 28.1, dwarf and half-shrubs 21.45, perennial herbs 16.35, and winter annuals 14.73 atmospheres.

Depression of the freezing point in triturated plant tissues and the magnitude of this depression as related to soil moisture, R. P. Hibbard and O. E. Harrington (*Physiol. Researches, 1 (1916), No. 10, pp. 441–454*).—The work here outlined, employing material from potato tubers, cabbage head leaves, apples, lemons, oranges, grapefruits, onion bulbs, and maize roots and tops, is considered to show that the lowering of the freezing point in ground plant tissues is as valuable a criterion for the comparison of osmotic concentrations in the tissues as is the corresponding index for the expressed sap. The material, after being frozen, then triturated, and finally tested in a Beckmann freezing-point apparatus, gave concordant results from different samples of the same pulp and from pulps as compared with juices expressed from samples of the same pulp, provided the pressing had been thorough. Thus the determination of the freezing-point depression and of the osmotic concentration of tissues is rendered more simple, though the method is admittedly inapplicable to very small quantities of materials.

By this method, material from maize roots showed a much lower osmotic concentration than did material from the aerial portions.

Studies of protoplasmic permeability by measurement of rate of shrinkage of turgid tissues.—I, The influence of temperature on the permeability of protoplasm to water, E. M. Delf (*Ann. Bot. [London], 30 (1916), No. 118, pp. 283–310, figs. 17; abs. in Rpt. Brit. Assoc. Adv. Sci., 85 (1915), pp. 723–725, fig. 1*).—Developing a method of measuring indirectly changes in the permeability of protoplasm to water by ascertaining the changes in the rate of shrinkage of tissue bathed in solutions tending to plasmolyze the cells, the author studied the changes in protoplasmic permeability corresponding to temperature changes between 5 and 42° C. In discussing the tissue shrinkage obtained in dilute sugar solution, he states that the permeability of protoplasm for water is increased by increase in temperature so far as studied (up to about 42°),

the several values being tabulated. An approximate measure of the increase is furnished by sets of temperature coefficients shown for each rise of 10° between 5 and 40° by the onion leaf and dandelion scape.

Further studies on foliar transpiring power in plants, A. L. Bakke and B. E. Livingston (*Physiol. Researches 2 (1916), No. 2, pp. 51–71, figs. 3*).—These studies carry forward the work previously reported (E. S. R., 34, p. 334), employing herein *Xanthium canadense* and *Helianthus annuus*. The tests were made on leaves of various ages and at different hours.

The results are said to agree throughout in showing a daily cycle of change in the average foliar transpiring power of the plant, as a whole, from low night values to high day values and vice versa, as already ascertained in other plants. The maximum value of the average index of foliar transpiring power occurred about the tenth hour of the day in July and August, the two plants behaving much alike in this respect. The minima occurred about the eighteenth or else about the twenty-second or twenty-third hour of the day, and are also much alike for the two plants. Apparently the diurnal is three to five times the nocturnal transpiring rate. The increase occurring within one hour from just before sunrise to just after amounts to 240 per cent in Xanthium and 90 per cent in Helianthus. Older branches attain to lower maximum values and have more restricted daily ranges.

A single index to represent both moisture and temperature conditions as related to plants, B. E. Livingston (*Physiol. Researches, 1 (1916), No. 9, pp. 421–440, fig. 1*).—This is a more detailed account than that previously noted (E. S. R., 35, p. 732).

The respiration of partly dried plant organs, A. M. Smith (*Abs. in Rpt. Brit. Assoc. Adv. Sci., 85 (1915), p. 725*).—Tests were made with such plant organs as leaves of snowdrop, stem tips of Tropæolum, and young stems of asparagus, by depriving them, by means of a vacuum desiccator, of different proportions of the water they contained and then measuring their output of carbon dioxid.

The results show that in some cases respiration was increased after the plants had been deprived of one-third to one-half of their water content. The experiments thus far completed, while inconclusive, do not indicate reversibility in this process.

Investigation of the course of respiration with various degrees of deprivation of water content (fresh plants being used for each test) showed three phases of the course of the resulting respiration. Up to about 30 per cent of water loss, the increase of respiration was proportional to the loss of water. Respiration then remained about the same during a decrease of water content ranging from 25 or 30 per cent up to 50 or 60 per cent. Above this limit to that of complete dryness, respiration decreased proportionally to the amount of water lost.

The meaning of the increased protoplasmic respiration in partly dried material is deemed not clear. It has been suggested that the increased respiration shown in these experiments may be due to the increased activity of one or more enzyms.

Physiological studies on the maturation of seeds, S. L. Ivanov (*Soobshch. Bi͡uro Chastn. Rast. [Petrograd], 3 (1916), No. 2, pp. 49*).—The author, reporting upon a series of studies with pure lines of peas, flax, wheat, and oats. claims that the capacity of being changed into insoluble forms is the chief factor in the transmission of mineral and organic substances from stem to seed. In case of annuals the maturing of seeds exhausts the plant and thus leads eventually to its death. The process of maturation of the seeds has a

decided influence on the development of the fruit. In legumes the growth of each seed influences the development of the corresponding portion of the fruit. The transfer of food from stem to seeds begins after the processes which determine seed shape have been completed.

Under the influence of a humid atmosphere the yield of cereals was reduced while that of peas was increased, the ash content of peas and wheat was increased while that of oats was lowered, albuminoid substances were increased in all seeds, and the oil content of flax was slightly diminished. Shading lowered the yield of oats and peas but that of wheat was somewhat increased. The ash content was generally increased, as was also the albuminods in peas and wheat. Slight shading resulted in an increase in the starch content of seeds, while the oil content of flax was lowered. The quality of the oil was not influenced by slight shading, but with heavy shade the iodin number was below normal.

A resting period for a variety of durum wheat was found to be unnecessary as the seed would readily germinate before complete maturity.

The formation of auximones from nitrogenous organic substances, W. B. Bottomley (*Abs. in Rpt. Brit. Assoc. Adv. Sci., 85 (1915), pp. 728, 729*).—A method for investigating the presence of auximones has been developed in consequence of the observation that on crude nitrifying culture solutions containing these substances, a bacterial scum is formed. It has been found that during the germination of seeds, auximones are formed, and that they enable the embryo to utilize the food materials in the seed. Auximones are formed during the humification of nitrogenous organic matter, and the amount of auximones present depends upon the extent of humification. Fresh manure, rotted manure, and bacterized peat have been found to contain auximones in the proportion of 1 : 5 : 250. Experiments carried out as described, on *Lemna minor* growing in Detmer's culture solution, are considered to show that the purer auximone silver fraction is more effective on growth than the cruder phosphotungstic fraction.

The location of spore masses in the Uredineæ and its value as a character in classification, F. Grebelsky (*Centbl. Bakt. [etc.], 2. Abt., 43 (1915), No. 25, pp. 645–662, figs. 12*).—Concluding a study of several species, mainly of Puccinia and Uromyces, on various hosts named, the author states that a close and almost universal relation may be asserted between the position of the spore masses and that of the stomata as dorsal or ventral in case of the uredospores. The same is true in a considerable degree in case of the teleutospores.

The position of the spore masses can not, then, be regarded as a systematic character unless it be indirectly, in so far as choice of host is a species character, certain species living on hosts which have stomata on the one or the other leaf surface. For some other species the position of the teleutospores is characteristically independent of that of the stomata. It is, therefore, necessary to know the degree of dependence or independence in this respect in employing the position of spore masses as a species character. As regards those cases where the spore masses lie beneath the stomata, further investigation is required regarding the part played by the influence of negative hydrotropism and the advantages of access to oxygen.

Studies on the succession and ecology of epiphytic bryophytes on the bark of common trees in Denmark, C. Olsen (*Bot. Tidsskr., 34 (1917), No. 7, pp. 313–342, figs. 4*).—The author reports that epiphytic bryophytes are always found in woods on one side of the tree stem and not on the other. This is accounted for by the fact that most forest trees deviate from the perpendicular more or less, and it is on the upper sides of such trunks that the mosses are

found. Their occurrence on the upper side of the trees is explained by the fact that rain in a wood nearly always falls vertically, with the result that the upper side of the tree trunk, being more exposed, obtains a greater share of the rainfall than the lower. The bryophytic vegetation is said to be most abundant upon trunks with an inclination of more than 10°, while on perpendicular trunks such vegetation is very nearly or entirely lacking.

With trees standing in the open, a more upright habit of growth results, and the occurrence of bryophytes on trunks is as a rule infrequent, but where they are found, they may occur on all parts of the stem. This is claimed to be due to the fact that in open ground the rain may come from all quarters. On such isolated or exposed trees, lichens are of more frequent occurrence than mosses.

A note on the inheritance of eye pattern in beans and its relation to type of vine, F. M. Surface (*Amer. Nat., 50 (1916), No. 598, pp. 577–586, figs. 3*).—The author has made a genetic study of the two types of beans previously mentioned (E. S. R., 33, p. 635), carrying a few to the F_2 generation.

In addition to the two parent types, a third appeared in both the F_1 and F_2 generation, showing a piebald pattern as regards color distribution. This is thought to be the expression of the heterozygous condition of the factorial differences between the parent types. A provisional hypothesis for the types thus far known is outlined on the basis of the admittedly scanty data which have been obtained. Apparently the gene for the bush type of vine is closely associated with that for one of the original patterns.

A quantitative study of the factors influencing the weight of the bean seed.—II, Correlation between number of pods per plant and seed weight, J. A. Harris (*Bul. Torrey Bot. Club, 43 (1916), No. 9, pp. 485–494, figs. 4*).—This study, made in pursuance of those previously noted (E. S. R., 32, p. 521), showed that throughout the 27 series of cultures used, representing five varieties, the correlations for seed weight and number of pods per plant were positive, but of small magnitude and variable. In both average magnitude and variability the correlations for seed weight and number of pods per plant agreed very well with those for ovule per pod and pods per plant and with those for seeds per pod and pods per plant.

The average value of the correlation for pods and weight was lower than that for pods per plant and ovules per pod, and higher than that for pods per plant and seeds per pod, but both of these differences are low and may not be significant in comparison with their probable errors.

On selective partial sterility as an explanation of the behavior of the double-throwing stock and the petunia, Edith R. Saunders (*Amer. Nat., 50 (1916), No. 596, pp. 486–498*).—This is a critical discussion of portions of the preliminary paper by Frost, previously noted (E. S. R., 34, p. 237).

Application of the pure-line concept to bacteria, L. J. Cole and W. H. Wright (*Jour. Infect. Diseases, 19 (1916), No. 2, pp. 209–221*).—From a consideration of experiences and observations in connection with the production and study of bacterial cultures, the authors have concluded that much of the variation observed in ordinary cultures is due to the selection, by investigator or environment, of pre-existent biotypes, and the suppression or extinction of others. This leads to a temporary or permanent change in the character of the type, and, in the latter case, gives rise to a change which may be erroneously taken for a true hereditary mutation. Incomplete selection may be followed by the reappearance of a suppressed type on the restoration of former conditions.

The descendants of a single cell constitute a pure line, or clone, which can not be modified by selection, though mutation is not excluded and does occur in pure lines, both spontaneously and in response to environmental stimulus. The

new races, or biotypes, vary about modes of their own, and are not permanently modifiable. Such mutations may become appreciable only by statistical methods. The biotypes constituting ordinary bacterial cultures have arisen and persisted as mutations.

Nitrocultures and their commercial application, F. C. HARRISON (*Proc. and Trans. Roy. Soc. Canada, 3. ser., 9 (1915), Sect. IV, pp. 219–223*).—The author reviews the applications of the methods employed in experiments by himself in connection with Barlow (E. S. R., 17, p. 950; 19, p. 528), and gives in tabular form the results obtained in later tests by himself. He states that the best growths were found among those obtained from the alsike culture on saccharose, those from vetch culture on dextrin dipotassium phosphate, and those from alfalfa, soy bean, and red clover culture on wood ash agar. Combinations were also tried, and for the last two years 1 per cent saccharose and ½ per cent mannite have given good results.

The composition of the media and the mode of preparation of the cultures for distribution are described in some detail.

FIELD CROPS.

Contributions to agronomic terminology, II–IV, C. R. BALL and C. V. PIPER (*Jour. Amer. Soc. Agron., 8 (1916), Nos. 3, pp. 197–204; 4, pp. 228–237; 5, pp. 310–315*).—The glossary of agronomic terms previously noted (E. S. R., 35, p. 30) is continued. Part 2 defines 14 terms relating to plants, 10 to roots, 24 to shoots and buds, 26 to stems and branches, 29 to leaves, and 7 to epidermal appendages; part 3, 31 terms relating to inflorescence, 74 to flowers, and 80 to fruits and seeds; and part 4, terms denoting pubescence, protuberances and inflations, excretions, punctations, and perforations.

Relative precision of formulas for calculating normal plat yields, W. W. STOCKBERGER (*Jour. Amer. Soc. Agron., 8 (1916), No. 3, pp. 167–175*).—This paper discusses the precision of certain formulas commonly used for calculating normal plat yields. The methods are compared in field experiments with hops, including fertilizer tests and variations in cultural methods.

The normal yields for the plats varied widely according to the methods of computation, the values in some cases differing from the actual yield by 40 per cent. The errors introduced by the use of the formulas discussed may be remedied in part by correcting for imperfect stand and by replication. Correcting to full stand does not always result in increased precision. Replication brings about a very marked reduction in variability, although with only five replications the error is still relatively large.

The root systems of agricultural plants, E. C. MILLER (*Jour. Amer. Soc. Agron., 8 (1916), No. 3, pp. 129–154*).—This is a review of the literature on the root systems of agricultural plants gathered by the author in his studies of the roots of corn and sorghum (E. S. R., 35, p. 437). The review includes (1) the extent of root systems, including methods for their isolation, (2) the relation of the weight of roots to the aerial portion of the plant, and (3) the influence of moisture, fertilizers, and oxygen on root growth and development. A number of tables are given which, for the most part, have been abstracted and rearranged, and many new calculations made in order to bring out the most important facts. Sixty-four articles are reviewed and listed in the bibliography at the end of the paper.

[Work with field crops in 1916] (*Wisconsin Sta. Bul. 275 (1917), pp. 24–34, figs. 6*).—A further study by E. J. Delwiche of the problem of controlling lodging of oats has given results similar to those previously noted (E. S. R., 35,

p. 528). White Jewel has again proved to be the most resistant variety found, showing a loss by lodging of 40 per cent in comparison with losses as high as 90 per cent sustained by other standard varieties.

Owing to the open and severe winter of 1915–16 serious winterkilling of alfalfa was experienced. L. F. Graber, in tests with different strains of alfalfa originating from both northern and southern grown seed of the purple varieties, as well as variegated strains (including the Baltic and Grimm), found nine plats of northern-grown seed showed 55 per cent winterkilling and 3,840 lbs. of cured hay per acre; two plats of southern-grown seed, 52 per cent winterkilling and 4,470 lbs. of hay; one plat of an imported variety (Turkestan) 31 per cent winterkilling and 5,540 lbs. of hay; and four plats of variegated strains showed 27 per cent winterkilling and 6,045 lbs. of hay.

Observations indicate that seedings of common alfalfa are much more susceptible to winterkilling the second winter than the first. The so-called "hardy alfalfas," the seed of which was derived from 25- to 35-year-old fields in Montana and Dakota, were no more resistant to winterkilling or superior in yields than the common strains from those States.

Comparative tests of 34 different strains of alfalfa on 2- and 3-year-old growths indicate that there is no correlation between hardiness and the nature of the root growth. Observations show that all of the principal strains of American grown alfalfa possess both the tap root and branched types of root systems.

Brief notes are given on Sudan grass for Wisconsin. Seedings of from 20 to 25 lbs. per acre from June 1 to 10 are recommended. An average yield of 3.5 tons of hay per acre has been secured, while a yield of 12.8 tons of forage per acre was realized when sown in cultivated rows for soiling purposes.

Of the corn varieties adapted to upper Wisconsin, Wisconsin No. 25 is recommended by E. J. Delwiche for sandy and sandy loam sections not over 1,200 to 1,300 ft. in altitude, as it matures ten days earlier than Wisconsin No. 8 (a northern bred variety) and yields approximately 75 bu. per acre. For the cooler climate and heavier soils of the Superior region Wisconsin No. 25, No. 23, Northwestern Dent, and Whitecap Dent mature sufficiently early to make good silage.

The work in wheat breeding conducted at Madison by B. D. Leith and at Ashland by E. J. Delwiche has been continued, with Pedigree No. 2 again giving the highest yields and surpassing all other varieties in milling tests as to volume of loaf. A number of pure-line selections and cross selections developed at Ashland have shown exceptional merit, some yielding 25 per cent over the standard Blue Stem type. Several of these pedigreed strains yielded from 51 to 55 bu. per acre this year, while the soft winter varieties yielded about 4 bu. more than the hard varieties. Efforts are being made to improve the rust-resisting qualities of these strains by selection.

Work with the soy bean for seed production has been continued. Pedigree No. 2 of the Ito San variety has given the best results at Madison, while Early Black has proved best for upper Wisconsin. Black Eyebrow has been found well adapted for both hay and silage purposes.

Brief notes are given on the management of sweet clover.

The development of the hemp industry has been continued under A. H. Wright. The production of fiber in 1916 was estimated at 1,500 lbs. per acre with a value of $105. The total estimated value of the crop for the State is $125,000. Field tests are in progress to determine the suitability of various soil types for hemp production and to ascertain whether or not hemp seed could be matured profitably in the State. Efforts are being made to improve the strains used for cultivation, especially as to early maturity, using Minnesota No. 8 for selection.

Experiments with farm crops, F. App (*New Jersey Stas. Rpt. 1915, pp. 181–183*).—Sudan grass seeded June 15 yielded 10.2 tons of green forage as compared with 8.7 tons of Japan millet used as a check. Sudan grass did not prove exceptionally palatable when fed to cows. A seeding of this grass May 15 did not begin to make vigorous growth until late in June, while the later seeding of June 15 was vigorous from the beginning. Sudan grass is not considered far superior to the millets as a forage crop for New Jersey north of New Brunswick.

In variety tests with corn, the highest-yielding variety (a Leaming strain) produced at the rate of 67 bu. per acre and the lowest-yielding variety 26.9 bu. The variety giving the highest grain yield likewise gave the highest stover yield, at the rate of 3.66 tons per acre.

[**Field crops work on county experiment farms in Ohio in 1915**, C. W. Montgomery et al. (*Ohio Sta. Bul. 303 (1916), pp. 73–102, 107–126, 129–147, 149–152, 153–166, 168–172, 174–176, 185–197, 200–207, figs. 17*).—This reports work in 1915 at the experiment farms located in Miami, Paulding, Clermont, Hamilton, and Washington counties in continuation of that previously noted (E. S. R., 33, p. 828), together with work in Hancock County last reported on in 1911 (E. S. R., 28, p. 40) and in Trumbull and Mahoning counties, which is reported here for the first time. The reports for the several farms include the results of rotation tests, including corn, oats, wheat, clover, soy beans, sugar beets, potatoes, and tobacco; fertilizer and barnyard manure experiments with the crops in rotation; liming tests; variety tests with corn, oats, wheat, and soy beans; fertilizing experiments with pasture lands and alfalfa; early and late seeding tests with wheat; a depth of plowing test with corn and soy beans; and a comparison of Sudan grass with German millet on the Paulding County farm. The data obtained from the fertilizer and barnyard manure experiments and the variety tests at all the stations are summarized in tabular form, together with data showing the direct and residual effect of chemical fertilizers and barnyard manure.

In comparing Sudan grass with millet on plats in which both were drilled solid, the Sudan grass exceeded the millet by an average of 1,250 lbs. of hay per acre.

In all cases, except on the Paulding County farm, acid phosphate has produced profitable increases in crop yields. The larger quantities of acid phosphate used in the more recent experiments have not yet produced increased yields proportionate to the quantity applied, as compared with the results at Wooster and Strongsville, the increases in these tests for the first five years amounting to 4 bu. of corn in each case and less than 2 bu. of wheat at Wooster and 5¼ bu. at Strongsville.

The average increase of corn in the 12 tests has been 5¼ bu., obtained with an average application of 152 lbs. of acid phosphate, and the average increase of wheat 5⅜ bu., with an average application of 157 lbs. The addition of an average of 50 lbs. of muriate of potash has increased the average yield of corn in the 12 tests by a little more than 2½ bu. and that of wheat by 1⅓ bu., sufficient to cover the cost of the additional fertilizer in either case.

The addition of 63 lbs. of nitrate of soda per acre on corn and of 83 lbs. on wheat to the combination of acid phosphate and muriate of potash resulted in average increases of only 1½ bu. of corn and 2 bu. of wheat, insufficient to cover the cost of the nitrate.

In comparing the direct and residual effects of barnyard manures in a 5-year rotation at Wooster, it was found that for the 20 years 1894–1913 the direct effect of an 8-ton application to both the corn and wheat crops amounted to increased yields conservatively valued at $23.74 per acre, while the residual

effects resulted in increased yields valued at $22.87 per acre. Similarly with the 4-ton application the direct increase is valued at $14.91 and the residual at $13.49 per acre.

A further comparison of the direct and residual effects of a complete chemical fertilizer when applied to corn and wheat and to wheat alone shows that the chemical fertilizer, which cost $7.45 for the corn crop and $8.60 for the wheat crop (at prices prevailing before the war), produced a direct increase valued at $22.47, nearly the same as the 16 tons of barnyard manure, but the residual increase from the chemical fertilizer amounted to only $11.85 per acre, or about half that from the manure. When the fertilizer was applied to wheat only, the residual increase extending through the four crops following was relatively larger than when both crops were fertilized, amounting to 80 per cent of the direct increase.

Report of the Bugyi experimental plat for the year 1914–15, E. Thompstone (*Dept. Agr. Burma, Rpt. Bugyi Expt. Plot, 1914–15, pp. 5*).—This is a progress report of investigations being conducted near Bugyi. The objects of the project are to introduce paying dry crops, to test deep and early cultivation, and to find a good rotation crop for sesame, the principal crop of the region. Of the crops tested, pêsingôn (*Cajanus indicus*), pyaung (*Sorghum vulgare*), and pebyugyi (*Phaseolus lunatus*) are said to give promise for the future. Brief notes are also given on castor, cotton, peanut, and sesame.

Experiments with spring cereals at the Eastern Oregon Dry-Farming Substation, Moro, Oregon, D. E. Stephens (*U. S. Dept. Agr. Bul. 498* (*1917*), *pp. 37, figs. 16*).—This bulletin deals with varietal and cultural tests of spring-sown cereals, including wheat, oats, barley, emmer, and grain sorghums, conducted at Moro, Oreg., in cooperation with the Oregon Experiment Station during the 5-year period 1911–1915, inclusive.

The substation is situated at an elevation of approximately 2,000 ft. on a silty loam soil typical of the Columbia Basin in Oregon and Washington. The average annual precipitation in this region for the past 11 years has been 11.35 in., while the average seasonal precipitation (March to July, inclusive) for the 5-year period covering these experiments was 3.83 in. The average evaporation from a free-water surface was 45.07 in. during the 7-month period April to October, inclusive, for the same period. The ratios of evaporation in seasonal and annual precipitation are higher at the Moro substation than at the Nephi, Utah, or Moccasin, Mont., substations. The average frost-free period for the 5 years was 155.8 days, with the average date of the last frost (32° F.) May 2 and of the first frost October 5. The average wind velocity was 5.9 miles per hour. Considerable meteorological data are tabulated in detail and discussed.

Seventy-six varieties of spring wheat have been tested two or more years, with Pacific Bluestem used as a standard for comparison in all checks. During the 5-year period Early Baart (C. I. No. 1697) exceeded the standard variety by an average yield of 3 bu. per acre, Koola (C. I. No. 2203–2) surpassed it by 6.3 bu. for the 3-year period 1913–1915, and Karun (C. I. No. 2200–1) by 4.9 bu. for the same period. Of all the varieties tested Early Baart gave the highest average yield, 22.2 bu. per acre, for the 5-year period, while the selection from Koola gave the highest average yield of 27.7 bu. per acre for the 3-year period.

The bearded varieties of common wheat exceeded the yield of the beardless common and club wheats by 1.7 bu. per acre.

The durum wheats have not yielded so well as the common and club varieties. The average yield of 14 varieties of the latter exceeded the average yield of

Blé Noir and Kubanka, durum wheats, by 3.5 bu. for the period 1913–1915. The average yield of the highest yielding common wheat exceeded that of the highest yielding durum wheat by 7.7 bu. per acre for the same period.

The spring wheat varieties Pacific Bluestem, Little Club, Early Baart, Karun, Koola, and Talimka, which have given the best average results, are described and discussed.

Data are given on the chemical analysis of the grain and flour of several of the spring wheat varieties tested, together with milling and baking tests conducted by the Plant Chemical Laboratory of the Bureau of Chemistry. All the varieties appear to be equal to and most of them superior to Pacific Bluestem.

Date- and rate-of-seeding tests with Pacific Bluestem indicate that seedings of about 5 pk. per acre as early in the spring as possible give the best results. For late seeding, 3 pk. per acre gave the highest yields. The average increase in yield from early seeding for a 4-year period was 6.2 bu. per acre.

Of the spring oat varieties tested, the early varieties such as Kherson and Sixty Day gave the best results, although Siberian, a midseason variety, has yielded practically as high as early varieties. The Kherson, Sixty Day, Siberian, and Canadian varieties are described and discussed.

Forty-three varieties of spring barley have been tested and 5-year average yields obtained for 13 varieties. Mariout (C. I. No. 261), a 6-rowed form, gave the highest average yield of 34.3 bu. per acre for the 5-year period. The 2-rowed forms White Smyrna and Hannchen gave average yields of 33 and 32.2 bu. per acre, respectively, for the 6-year period. The leading spring barley varieties are briefly described.

Spring emmer has not proved so drought resistant as spring wheat, oats, and spring barley. The average yield of one variety (C. I. No. 1524) for the 5-year period was 21.8 bu. (32 lbs. per bu.) per acre, or less than half the weight obtained with Kherson oats or Mariout barley for the same period.

Variety tests of grain sorghums included Manchu and White kaoliang, milo maize feterita (Sudan durra), and Kafir corn. All but Manchu kaoliang have been discarded as unsatisfactory.

Two varieties of broom corn have been tested and have given fair seed yields, but the brush is of poor quality.

The 5-year average acre yield in pounds of the highest yielding varieties of the three leading cereals was as follows: Wheat, 1,362 lbs.; oats, 1,402 lbs.; and barley, 1,646 lbs. Based on the 10-year (1905–1914) average farm price of these cereals in Oregon, the acre value of wheat would be $18.39, of oats $19.35, and of barley $20.35.

Seeding winter grains in furrows to prevent winterkilling, S. C. Salmon (*Jour. Amer. Soc. Agron., 8 (1916), No. 3, pp. 176–188, pls. 2, figs. 2*).—This paper, from the Kansas Experiment Station, discusses numerous experiments with seeding winter grains in furrows to prevent loss through winter injury. While most of the experiments were conducted in Kansas, several investigations outside of that State are cited and numerous references made to the literature on the subject. The general conclusions drawn are as follows:

In general, grain sown with a drill survives the winter better than when sown broadcast. Seeding in furrows tends to prevent winterkilling and damage from blowing in dry areas. The furrows catch and retain snow, modify the temperature, protect the plants from wind, and probably reduce injury due to heaving. Winter oats sown in furrows survived 87.5 per cent in one season as compared with 7.5 per cent when sown in the ordinary way, and winter barley survived 87 per cent while that sown with the disk drill was entirely killed. Wheat did not show a marked advantage from seeding in furrows, (1) because wheat sel-

dom winterkills, (2) because of poor drainage, and (3) because of certain limiting factors which entered into the field tests.

It is stated that grain should not be sown in furrows where the land is poorly drained, nor on hillsides subject to erosion. This method appears to be especially promising for areas where the moisture supply is deficient, and where the winters are cold and characterized by light snowfall and frequent winds.

The effect of clipping on the root development of alfalfa, R. McKee (*Jour. Amer. Soc. Agron., 8 (1916), No. 5, pp. 329–332*).—This is a brief account of some alfalfa investigations conducted at Chico, Cal., during the seasons of 1912, 1913, and 1914.

The effect of clipping alfalfa the first season was studied with special reference to root development, and it was found that clipping materially reduced the diameter of the root immediately below the crown. The effect of clipping the first season on the subsequent yield of hay, as observed so far as the length of the experiment permits, was indicated to be that clipping the first year reduces the subsequent yields of hay, especially in the first and second season, unless the clipping is essential for weed control.

Corn.—Varieties and limiting factor tests, season 1916, W. L. Hutchinson (*South Carolina Sta. Bul. 190 (1917), pp. 7*).—Tests with 16 varieties of corn at Clemson College and 17 varieties at the Pee Dee substation are reported.

Lowman Yellow gave the highest yield at Clemson College, with 43.2 bu. per acre, and Marlboro the highest at Pee Dee, with 45.7 bu. Lowman Yellow was second at the Pee Dee substation, with 44.6 bu. The lowest yielding variety at both stations was Hickory King, with 29 and 26.8 bu., respectively.

Limiting factor studies with various fertilizers were continued with the same results as previously noted (E. S. R., 35, p. 338). The check plats at the Pee Dee substation, growing cowpeas with corn in a two-year rotation of corn and cowpeas and cotton, gave good yields, indicating that the soil is being improved without the aid of fertilizers.

Corn, yields per acre and prices, by States, 50 years 1866–1915 (*U. S. Dept. Agr. Bul. 515 (1917), pp. 16*).—Tabulated statistics are given for the yield of corn per acre, prices, and values for each year of the 50-year period 1866–1915 in the United States, the several divisions of States, as North Atlantic, South Atlantic, etc., and by States.

Cotton.—Varieties and limiting factor tests, 1916, W. L. Hutchinson (*South Carolina Sta. Bul. 189 (1917), pp. 8*).—Continuing work previously noted (E. S. R., 35, p. 136), results of tests with 26 varieties of cotton at Clemson College and of 30 at the Pee Dee substation are reported.

It is recommended that the Webber-Columbia types of long-staple cotton be carefully selected for length of fiber, without lessening their good qualities, in order that they may be clearly grouped as long-staple varieties, even when grown under adverse conditions. The Cleveland, Cook (when free from anthracnose), Sawyer, and Pulnott are reported as having outstanding merit in the short-staple group.

At Clemson College the Webber variety was first, with a total value of $157.54 per acre, and Columbia second with $137.04. Of the short-staple types Simmons Cleveland stood first, with a total value of $133.78. For the varieties tested the rate of yield of lint ranged from 272 to 608 lbs. per acre, and the percentage of lint from 28 to 40.

Alabama Cook, with a total value of $131.92 per acre, stood first at the Pee Dee substation and Pulnott second, with a total value of $124.39. The range in the rate of yield of lint for the varieties tested at this station was from 210 to 608 lbs. per acre, and the percentage of lint from 29 to 39.

Limiting factor studies with various fertilizers are reported in tabular form.

Report on the manuring of mangels, J. PORTER and A. S. MCWILLIAM (*Herefordshire Ed. Committee, Farmers' Bul. 9 (1915), pp. 9*).—This is a report of fertilizer experiments with mangels which have been in progress since 1908. Five combinations of commercial fertilizers were used in the test in addition to a dressing of barnyard manure of from 12 to 14 tons per acre. All of these fertilizer applications were made at seeding time, and on four of the five fertilized plats a top-dressing of sodium nitrate was added at singling time. The fertilizers used were ammonium sulphate, nitrolime, nitrate of soda, calcium nitrate, acid phosphate, basic slag, potassium sulphate, and sodium chlorid. All the treatments were made in triplicate at each of the 11 centers where the experiments were conducted. The general conclusions drawn from the experiments to date are as follows:

All mixtures of fertilizers when used with farmyard manure have been followed by profitable returns, the average increases varying from 4 to 7 tons per acre. A top-dressing of sodium nitrate has resulted in an average increase of mangels of 3 tons per acre, and when the nitrogen was applied in the form of calcium nitrate the same average increase was obtained at approximately one-half the cost. With ammonium sulphate slightly higher results have been obtained than with its equivalent in nitrolime. Acid phosphate on gravelly soil gave better results than basic slag, while on the heavier soils the results were almost identical. The following mixture of commercial fertilizers has given the largest increase in yield and the greatest profit: 0.5 cwt. ammonium sulphate, 3 cwt. acid phosphate, 0.5 cwt. potassium sulphate, and 2 cwt. salt applied at seeding time, with 1.25 cwt. calcium nitrate applied as top-dressing shortly after singling.

A classification of the varieties of cultivated oats, W. C. ETHERIDGE (*New York Cornell Sta. Mem. 10 (1916), pp. 81–172, pls. 22, figs. 22*).—This reports the development of a usable system of classification of the American varieties of oats grown in the environment of New York State in an effort to clear to some extent the confusion in varietal nomenclature. A review and discussion of the work of others has shown that a classification of oat varieties, in order to be effective, must be based on the morphology of the plant. The present cassification, therefore, follows (1) a study of the morphology of the plant to discover the various characters by which individual varieties may differ; (2) an analysis of varieties en masse to reach the types which for present purposes are considered elemental, that is, types that differ in one or more morphological characteristics; and (3) an arrangement of varieties in groups regardless of nomenclature, according to their likeness to the elemental types that represent the groups. The groups are fully described and named, and a key constructed for their identification. The naming of groups consisted in applying the name that occurred most frequently among the specimens of each group, although all additional different names were reserved and arranged as synonyms.

Specimens numbering 731 have been classified in the study, the bulk of which were brought together in 1909 at the Nebraska Experiment Station by E. G. Montgomery and M. S. Jussell, who laid the foundation for this work. The original collection included all varieties then grown or offered for sale in the United States. During 1913, 1914, and 1915 this collection was supplemented by accessions from the Office of Cereal Investigations of the U. S. Department of Agriculture (with which the author cooperated) and from various other sources.

The morphology of the oat plant is discussed in considerable detail, together with a description of the important taxonomic characters, and their uses in previous classifications and in the present one explained.

The principal cultivated varieties of oats, together with their basic wild species, are classified in eight groups, the elemental types being *Avena nuda*, *A. sterilis*, *A. abyssinica*, *A. strigosa*, *A. brevis*, *A. fatua*, *A. sativa*, *and A. sativa orientalis*. Fifty-five varieties are described within the three common specific groups, *A. sterilis*, *A. sativa*, and *A. sativa orientalis*. The varieties are systematically arranged with respect to such morphological differences as appear best to fulfill the requirement of constancy in inheritance and ease of observation and which should reasonably be expected to appear under other environments. The cassification takes no account of differences in ability of varieties to yield.

An extensive bibliography is appended.

Studies on oat breeding.—III, On the inheritance of certain glume characters in the cross Avena fatua × A. sativa, F. M. SURFACE (*Genetics, 1 (1916), No. 3, pp. 252-286, pls. 2*).—Continuing work previously noted (E. S. R., 33, p. 38), this paper deals with the inheritance of certain characters of the flowering glumes of the cross of *A. fatua* with *A. sativa*.

A. fatua, known as the wild parent, possesses the following glume characters which enter into consideration in this paper: The flowering glumes are black or dark brown in color. The lower and upper grains of each spikelet bear heavy geniculate and twisted awns. Pubescence occurs on the back of both the upper and lower grains, about the base of each grain, and on the pedicel of each grain. The base of each grain is expanded into a broad sucker-like ring which permits of easy shattering.

The grain of *A. sativa*, the cultivated parent, is yellow. Awns are completely lacking except in an ocasional spikelet, where the lower grain only may possess a very weak awn. All pubescence on regions noted above is lacking. The base of the grain is narrow and contracted and the grain does not shatter.

The F_1 plants are as a rule intermediates. The grain is brown in color, and medium heavy awns are present on the lower grain of some spikelets, although no awns are ever found on the upper grain. The lower grain is pubescent on the back, but the upper grain is smooth. There is a tuft of hair at the sides of the base of the lower grain, but not on the upper. The base of the lower grain is intermediate in character, and that of the upper grain is like the cultivated parent. The grain does not shatter.

Data are available from 465 F_2 plants, about 70 of which have been grown in the F_3 generation. Observations show that *A. fatua* carries genes for gray, and possibly yellow, in addition to black. These colors segregate independently of each other and the observed ratio closely approximates the expected ratio, thus confirming Nilsson-Ehle's conclusion.

The base of the grain in *A. sativa* is dominant to that of *A. fatua* and segregates independently of color. The heterozygous condition in the lower grain can be observed in the majority of plants.

In this cross seven characters are correlated with the character of the base of *A. fatua*, as follows: Heavy awns on the lower grain, awns on the upper grain, wild base on the upper grain, pubescence on the pedicel on the lower and on the upper grain, pubescence on all sides of the lower grain, and pubescence on the base of the upper grain. The F_2 generation indicates that there is a degree of linkage of the gene for pubescence on the back of the lower grain with that for black color.

The gene for pubescence on the back of the upper grain segregates independently of color, except that in the absence of the gene for pubescence on the lower grain the former is unable to act. The gene for pubescence on the back of the upper grain is linked with the wild base.

Irish potatoes in Florida, A. P. Spencer (*Florida Sta. Bul. 133* (*1917*), *pp. 21–32, figs. 4*).—This is a revision of Bulletin 120 (E. S. R., 30, p. 528), with brief additional notes on the prevention of frost injury through proper cultural methods, and on potato diseases and their control.

The yield and nitrogen content of soy beans as affected by inoculation, J. G. Lipman and A. W. Blair (*Soil Sci., 1* (*1916*), *No. 6, pp. 579–584*).—Experiments conducted at the New Jersey Experiment Stations on the relative value of 13 different commercial inoculating materials, both on an unproductive acid sandy loam soil so treated as to make the nitrogen supply the limiting factor of growth and on a fertile silt loam soil, are reported.

It is concluded "that the use of inoculating material may be very desirable in the growing of soy beans, and perhaps of other legumes. The results recorded . . . confirm results previously recorded by . . . [the] station or by other stations. It appears that where the soil is lacking in the right type of *Bacillus radicicola* inoculation is eminently desirable, and that even where the organisms are present in limited numbers the addition of larger numbers may be profitable. It appears, further, that there is a marked difference in quality of different commercial preparations for soil inoculation, and that soils derived from different sources may vary as widely as, though not more widely than, commercial cultures as to their effectiveness in promoting nitrogen fixation by legumes."

Composition of sugar beets at various stages of the growing season, H. E. Zitkowski, M. P. Potvliet, and I. W. Reed (*Sugar* [*Chicago*], *18* (*1916*), *No. 6, pp. 296–298*).—Considerable data are presented on the composition of the nonsugars of sugar beets, both leaves and roots, at intervals of two weeks through the growing season. The determinations included the weights of leaves and roots, the sugar content, and analyses of the dry substance and ash.

The noteworthy changes occurring in the leaves were an increase in the chlorin, sulphates, and calcium oxid, with a definite decrease in the iron and alumina oxids and carbon dioxid. Similar results were obtained in the ash of the roots, except that phosphoric acid, which had a tendency to decrease in the leaves, seemed to increase in the roots. Calcium and magnesium oxids increased appreciably, while potassium and sodium oxids remained practically constant. The total ash content per 100 parts of dry substance decreased from 20.31 to 4.15 as the beets ripened.

Sugar-cane culture for sirup production in the United States, P. A. Yoder (*U. S. Dept. Agr. Bul. 486* (*1917*), *pp. 45, figs. 19*).—The field conditions and practices and the economics of sugar-cane production in the localities where sirup is the chief product of the cane are discussed in detail.

On the basis of estimates from producers and other data, it is concluded that the price of sirup in bulk must be above 23 cts. per gallon to afford any remuneration or profit to the owner or manager. The price of sirup in the general market in recent years has ranged from 28 to 35 cts. per gallon, while in 1915 it reached 40 cts. or higher.

Recommendations are made for the utilization of the by-products, composed of leaves and tops, bagasse (pomace or mash), and the skimmings, all of which are almost entirely wasted under present practices.

Effect of rate and date of sowing on yield of winter wheat, W. M. Jardine (*Jour. Amer. Soc. Agron., 8* (*1916*), *No. 3, pp. 163–166, fig. 1*).—This paper, from the Kansas Experiment Station, discusses some investigations on the relationship of the rate of seeding to the date of seeding winter wheat. It had been observed that varying results were obtained from sowing the same rate of seed on different dates, as frequently occurs in actual farm practice. Consequently in the fall of 1912, 24 $\frac{1}{10}$-acre plats were seeded, four at a time at

weekly intervals, at the rates of 2, 4, 6, and 8 pk. per acre, respectively, from September 16 to October 20. In 1913 and 1914 the experiments were repeated with the additional dates of September 8, October 28, and November 4. The yields of grain and straw for each date and each rate of seeding for each of the three years are given in tabular form, together with the averages for the 3-year period. The results are also shown graphically.

According to these results the 2-pk. rate of seeding produced as large yields as the 4-, 6-, or 8-pk. rates when sown before the last week in September, but after that date the heavier seeding produced larger yields on the average. This condition progresses until the 8-pk. rate, sown between the second week of October and November 1, produces nearly twice as large yields as the 2-pk. rate. The high yield of the 2-pk. rate can be explained by the heavy stooling of Turkey winter wheat when sown early in the season, while as the season advances this stooling decreases.

Field investigations have shown that it is unsafe to sow winter wheat anywhere east of the western third of Kansas earlier than September 25 in northern Kansas, and October 5 in southern Kansas, owing to the Hessian fly. It is evident, however, that such factors as rate and date of seeding must be kept in mind when efforts are being made to increase crop yields.

Wheat, yields per acre and prices, by States, 50 years 1866–1915 (*U. S. Dept. Agr. Bul. 514* (*1917*), *pp. 16*).—Statistics are given for wheat similar to those for corn noted on page 832.

Table for converting weights of mechanical separations into percentages of the sample analyzed, E. G. Boerner (*U. S. Dept. Agr. Bul. 516* (*1916*), *pp. 21, figs. 2*).—The regulations under the United States Grain Standards Act provide that an original sample of shelled corn must not be less than 2 qt. in quantity and that about 1½ pints must be placed in an air-tight container for moisture determinations. The remainder is to be placed in a cloth bag for the determination of color, damaged corn (not including heat damage), heat-damaged corn, and foreign material and cracked corn. The maximum and minimum percentages allowed for each of these factors is specified for each grade and these percentages are to be determined by weight. To save time the 2.5-pint samples are very frequently divided into smaller samples of approximately 250 gm. and, after the mechanical separations and weighings have been made, mathematical calculations are necessary to convert these weights into percentages. A table given in this bulletin enables the analyst to compute these percentages without any calculations for percentage equivalents, ranging from 0 to 40 for samples weighing from 240 to 260 gm., inclusive. These limits cover the entire range of corn of other colors, damage, heat damage, and foreign material and cracked corn specified in the numbered Federal Corn Standards.

Directions are given for the use of the table. It is deemed essential for accuracy that considerable care be exercised in obtaining the 250-gm. sample from the 2.5 pints of the original sample and, to insure representative sampling, it is recommended that some such device as that described in Bulletin 287 (E. S. R., 33, p. 836) be used.

Report of the department of seed analysis, J. P. Helyar (*New Jersey Stas. Rpt. 1915, pp. 143–150*).—The results of seed analyses for 1915 are reported and briefly discussed. Twenty per cent of the alfalfa seed examined showed the presence of Turkestan alfalfa, which, in a large number of cases, had been used as a substitute for American-grown seed.

An alien weed (*Jour. Dept. Agr. So. Aust., 19* (*1916*), *No. 10, pp. 898–900, fig. 1*).—This is a brief note on the appearance of *Xanthium canadense* in South Australia, with directions for its eradication.

HORTICULTURE.

[Report of horticultural investigations], M. A. Blake and C. H. Connors (*New Jersey Stas. Rpt. 1915, pp. 37–47, 53–64, pls. 6*).—A progress report on horticultural investivations in 1915 (E. S. R., 34, p. 143), including also notes on the general condition of the fruit and vegetable crops in the State, records of blooming dates of various fruits, ornamental trees and shrubs at the college farm, and a list of peach types and varieties added to the plantings at the farm.

A survey of the peach trees in commercial orchards within a radius of six miles of Hammonton was made by W. N. Cowgill, in cooperation with E. Douglas, and a total of 106,025 trees were noted. Tabular data are given showing the varieties of peaches, with age and number of trees of each, together with the five most popular varieties as represented by annual plantings from 1909 to 1915. A bud sport of the Elberta peach discovered near Vineland a few years ago is here described. The tree is semidwarf and compact in its habit of growth and the foliage a much darker green in color than is the case with any other variety in the orchard. The fruit resembles Elberta in form and color, though the specimens are commonly somewhat longer and more flattened than normal Elbertas. A record is given of seedling peaches growing in the nursery as a result of crosses made in 1914. The peach trees included in this breeding work were covered with tents of cheesecloth in order to better control the process of pollinating. A brief statement is given of progress in the Vineland peach experiments. Data on this work are to be published elsewhere.

Some abnormal forms of plant growth observed during the year are here described. These include the development of adventitious buds in the base of a bloom of *Calendula officinalis*, a carnation plant bearing flowers of two colors, fasciation in the apple, superficial injury to peaches, and peculiar markings upon peaches.

During the past year or two several investigations with vegetables have been started at the station, with L. G. Schermerhorn in charge. A study of garden beet varieties conducted by W. C. Pelton is here reported. Beet seeds of various varieties were secured from several different dealers and grown with the view of comparing their various characters to determine, if possible, a basis for standardizing varieties. The study thus far made indicates that there is no uniform standard for selection among beet-seed growers, there being a notable lack of uniformity in the varietal characters of the stocks. Germination tests of 100 samples of beet seed are here tabulated.

A study of color zones in beets was made by A. Kuntz. Variation in color of the zones was observed even in the same variety (Crosby Egyptian). Generally speaking, beets with light-green foliage commonly have a large proportion of white in the root and beets with dark-red foliage a large proportion of red in the root. At least one exception to this rule was noted. Size and vigor of foliage does not appear to affect the width of the zone formation in the root and variation in the number of zones of beets of the same age seems to follow no definite rule. Beets of different ages but having the same number of leaves formed have the same number of zones, providing that number is below five. With the development of more than five zones there appears to be no regular and uniform relation between number of zones and number of leaves. Development of new zones is concentric to a central zone, the new leaves as they appear indicating the development of a new zone farther from the center.

A survey was conducted by R. W. de Baun to determine what varieties of vegetables were most popular among the commercial growers of the State. The results are presented in tabular form. The results of sweet corn suckering experiments as conducted by the same investigator show that the hills not suckered gave the heaviest yield, while the hills from which the suckers were removed late in their growth gave the smallest yield. When suckering was performed more than once the yield was still further reduced. When suckering was conducted early in the growth of the plant the corn was ready for market about three days before that of the plants not suckered. The plants suckered later in the season were slightly earlier than those not suckered.

Some preliminary experiments conducted with horseradish by the same investigator indicate that larger sized and less branched main roots may be produced for market by removing the soil and stripping off the lateral roots from the upper part of the main root sometime during the summer. The yield of marketable roots was increased also by this method. Further work to determine the financial value of the stripping method is contemplated.

[Report of heredity investigations], B. D. HALSTED (*New Jersey Stas. Rpt. 1915, pp. 262–287, pls. 13*).—A progress report on breeding work with corn, peppers, and miscellaneous plants (E. S. R., 34, p. 144).

Among the results with new F_1 corn crosses, the character for floury endosperm appears to be recessive to the character for flintiness. With varieties in which the grains are normally zigzag or out of alinement this character is transmissible to the progeny of crosses with straight-rowed varieties. Selected zigzag ears from normally straight-rowed varieties do not tend to transmit the character for zigzagness when crossed with another straight-rowed variety. Observations of certain F_1 crosses showed an apparent inheritance of a character for isolated or widely spaced grains.

Studies of inheritance of row-number in corn indicate that an unusually low row-number in the parental ear may be followed by a decrease in the average row-number of the offspring, as compared with that from normal seed ears. Some general observations are given on a number of F_2 corn crosses. One point brought out from the preliminary observations made is the superiority of F_1 selections over F_2 selections, indicating the desirability of planting F_1 seed for crop production. Several F_2 crosses of Cuzco corn with United States field corns indicate the lack of value of Cuzco corn for breeding with local field types.

Further data are given on F_2 Golden Queen-Red Cluster pepper crosses. Among the phases considered are the relations of size of plants (single leaved), size of plants (double leaved), and size of fruit, to such characters as plant length, leaf length, and position, color, flavor, and walls of the fruit; the relation between height of plant and leaf length; correlation between length of leaf and width of leaf; and correlation between the size (weight) of fruits and the size (length) of their seeds. Observations are also given on variations in size of plant, leaf arrangement, the leaf, flower, fruit position, fruit color, fruit shape and size among F_3 Golden Queen-Red Cluster peppers, and on some F_4 Procopps-Cherry pepper crosses with special reference to variability in size and form of fruits.

Some new breeding work with nasturtiums, squashes and gourds, radishes, and daturas was undertaken and is here briefly considered. A study was made of abortiveness in relation to position in the pod on three crops of Mohawk bush beans. The data presented indicate that abortiveness is chiefly in the basal position and increases as the season advances.

Inheritance studies in garden plants, E. J. OWEN (*New Jersey Stas. Rpt. 1915, pp. 293–296*).—In continuation of previous work (E. S. R., 34, p. 146),

character transmission in some Scarlet Runner bean hybrids and bush bean crosses is briefly noted, and the records of breeding experiments with eggplants, okra, and Hibiscus, as well as the limitation studies with beans and peas, are presented in tabular form.

The results of five seasons' work with beans indicate that limiting the yield of the plant to one pod greatly increases the weight of the seed.

Truck crops, W. J. Green and E. J. Riggs (*Ohio Sta. Bul. 303 (1916), pp. 177–184, figs. 4*).—An outline is given of investigations of the Washington County truck farm, including the results of fertilizer experiments with sweet corn, cucumbers, cabbage, and tomatoes as determined by increased yield per acre under each treatment.

The results for the first season show that the crops grown on manured land have not been any larger than those on the land receiving chemical fertilizers, and that manure valued at $2 per ton has been a costly fertilizer as far as the first crop is concerned. It is pointed out, however, that a larger part of the effect of manure is realized in the succeeding crops than is the case with chemical fertilizers.

A chemical study of the asparagus plant, F. W. Morse (*Massachusetts Sta. Bul. 171 (1916), pp. 265–296*).—In connection with a long-continued series of fertilizer experiments on asparagus conducted at the station (E. S. R., 26, p. 44), the author investigated the chemical composition of the asparagus plant and the effect of different fertilizers upon the proportions of the more important plant constituents. The analytical data secured are presented in detail and fully discussed. See also previous papers (E. S. R., 30, p. 142).

As to the chemical composition and changes during different stages in the development of the asparagus plant, "during the earlier years of the asparagus field the crowns and roots steadily increased in size, doubling in weight between the second and fourth years after setting. The proportion of protein remained nearly constant in the dry matter of the roots during the period observed, while the sugar decreased and the cellulose and allied compounds increased. The composition of the young stalks cut in the spring changed as the cutting season advanced. Dry matter was practically constant, but sugar increased in proportion while protein decreased somewhat.

"The development of the asparagus tops to maturity was accompanied by a continuous increase in the cellulose and its related groups—pentosans and lignin. Protein and sugar decreased in their proportions, but were not wholly translocated to the roots from the ripened tops. Water was the dominant constituent of the asparagus plant in all the stages studied. It was highest in the young stalks. The summer or growing roots were a little more watery than the late fall or storage roots. Calcium oxid and sulphuric acid steadily accumulated in the asparagus tops as they grew old, but potash and phosphoric acid were transferred either to the fruit or back to the roots."

Relative to the effect of different fertilizers on the composition of the asparagus plant, it was found that "withholding one of the constituents of a complete fertilizer from the annual top-dressing was accompanied by a smaller average weight of roots in the samples taken from the plat thus treated. Withholding nitrate of soda lessened the percentage of nitrogen and of soda in the roots; withholding muriate of potash lessened the proportion of potash in the roots; withholding acid phosphate produced no apparent change in the constituents of the roots. An increase of nitrate of soda from the minimum to the medium amount in the top-dressing caused an increase in the percentage of nitrogen in the dry matter of the roots. An increase in the amount of muriate of potash produced some increase in the percentage of potash in the roots.

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"Asparagus roots taken from plats receiving the nitrate of soda in the spring were noticeably heavier in weight and a little poorer in nitrogen than roots from plats that were top-dressed with nitrate in the summer. During the cutting season the production of young stalks drew most heavily on the sugar contained in the roots, but there was no approach to exhaustion of that constituent. Fully twice as much sugar was consumed as would have been required to produce the carbonaceous matter in the young stalks. The roots apparently absorbed nitrogen, lime, and sulphuric acid during the cutting season. Potash and phosphoric acid were apparently supplied to the young stalks wholly from the reserves in the roots."

From the standpoint of cultural practice the chemical study has shown that a complete fertilizer rich in nitrogen is required in generous amounts in order to produce a continuous strong development of the asparagus plant. The physiological need of water, together with the sandy quality of most asparagus soils, indicate that irrigation would be advantageous, if not necessary, for the production of maximum crops. The reserve material stored in autumn in the roots was found to be principally sugars.

" Destruction of the tops by rust, or their premature removal to be rid of the berries, must lessen the amount of sugar which can be stored in the roots. The fertilizing constituents which were stored in the roots over winter appeared to be nearly, if not quite, sufficient for the full development of the succeeding spring crop. There was evidence of a small intake of nitrogen during the cropping season and a pronounced absorption of lime and sulphuric acid. Sulphuric acid was found to be equally, if not more, important than phosphoric acid among the constituents of the asparagus plant. Nevertheless, the sulphate of lime in the acid phosphate appeared to suffice fully for the needs of the crop."

Connecticut Valley onion supply and distribution, A. E. CANCE, W. L. MACHMER, and F. W. READ (*Massachusetts Sta. Bul. 169 (1916), pp. 49–122, figs. 40*).—A study of onion supply and distribution in the Connecticut Valley, including introductory considerations relative to onion supply, regions of production, and shipping periods in the United States as a whole. In part 1 the Connecticut Valley onion district is considered with reference to topographic features, onion soils, general marketing facilities, general history of onion growing in Massachusetts, economics of production, tenure of land, soils and climatic conditions, extent of industry, methods of culture, seed and sets, varieties, weeding, economic factors, harvesting, cost of production, and yields.

Part 2 discusses in detail marketing the crop, methods of sale, storage of onions, transportation of onions, problems of transportation, and prices of onions.

As a result of the investigation the authors present a number of recommendations suggesting improved methods of harvesting and marketing.

Root hardiness of fruit trees (*Wisconsin Sta. Bul. 275 (1917), pp. 34, 35*).—As here briefly summarized the studies of root hardiness being conducted at the station have shown thus far that little injury occurs at 21° F. When the temperature falls to 14° the cambium tissue is generally injured. Data on the influence of cover crops on the moisture content and temperature of the soil as a factor in root hardiness indicate that cover crops are chiefly of value in holding the snow, which has proved to be the best protection of the root system.

Observations on the production of scion roots have have been made on about 6,000 nursery trees. It appears doubtful whether apple trees produce sufficient scion roots, in a nursery at least, to support the tree in case the stock roots are winterkilled. The results thus far accumulated do not accord with the view sometimes advanced that winterkilling is largely due to desiccation of injured parts.

The cost of producing apples in western Colorado, S. M. THOMSON and G. H. MILLER (*U. S. Dept. Agr. Bul. 500 (1917), pp. 44, pls. 2, figs. 10*).—This is the second of a series of bulletins giving information relative to different methods of orchard management and the cost of apple production in different apple-growing districts (E. S. R., 36, p. 443). The present bulletin reports a detailed study made in 1914–15 of the current cost factors involved in the maintenance of orchards and the handling of the crop on 125 farms in the fruit region of Mesa, Delta, and Montrose counties, Colo.

The total cost of producing apples for the 125 farms represented averaged 84.4 cts. per box. Labor cost averaged 39.4 cts. per box and $111.88 per acre. Material and fixed costs averaged 45 cts. per box and $127.91 per acre. The average yield for the district was 284 boxes per acre. The trees in the orchards studied averaged 17 years of age and 74 to the acre. The average total investment per acre of apple orchard was $751.56. Jonathan was the leading variety, with Ben Davis, Rome Beauty, Gano, and Winesap following, each of about equal importance.

With the investigation as a basis the authors make suggestions relative to improvements in orchard management practice.

The cost of producing apples in Hood River Valley, S. M. THOMSON and G. H. MILLER (*U. S. Dept. Agr. Bul. 518 (1917), pp. 52, pls. 4. figs. 14*).—This is the third bulletin of the above-noted series and comprises a report of a detailed study made in 1915 of the current cost factors involved in the maintenance of orchards and the handling of the crop on 54 farms in the Hood River Valley.

In this region the total cost of apple production for the 54 bearing orchards averaged $1.02 per box and $222.83 per acre for orchards under clean cultivation and $232.32 per acre under mulch crops. The average cost per box exclusive of interest on orchard-land investment was 66.4 cts. Net labor costs averaged 38.3 cts. per box. Material and fixed costs constituted 62.5 per cent of the total cost. The trees in the orchards studied averaged 12 years of age and 72 trees to the acre. The average total investment per acre of apple orchard was $990.74; the average yield, 222 boxes per acre. The Hood River Valley appears to be particularly well adapted to the production of Yellow Newtown and Esopus apples, both of which grow to perfection there. Based on results of this study suggestions are given relative to local problems of orchard management.

The mulched-basin system of irrigated citrus culture and its bearing on the control of mottle-leaf, L. J. BRIGGS, C. A. JENSEN, and J. W. MCLANE (*U. S. Dept. Agr. Bul. 499 (1917), pp. 31, pl. 1*).—The work carried out by the authors in 1914 (E. S. R., 35, p. 754) showed that one-half of the mottling of orange leaves in about 120 orange groves investigated was associated with a low humus content of the soil. Evidence was secured in this work which indicated that inadequate irrigation might be responsible in part for the development of mottle-leaf. The present paper reports field experiments relating to the irrigation of oranges and the use of organic fertilizers in relation to mottle-leaf. It deals particularly with a new method of citrus culture, the "mulched-basin system," in which low dikes are thrown up so as to form large shallow irrigation basins near each tree and each basin is heavily mulched with alfalfa hay, bean straw, manure, or some other organic material.

In the experiments thus far conducted the mulched-basin system conserved soil moisture better than any other system of soil treatment compared with it and none of the basined trees on either light or heavy soils wilted. Under all the other cultural methods employed wilting occurred at some period during the summer on both light and heavy soils.

The new leaf growth on the basined trees was less mottled than the new leaf growth on the unbasined trees after sufficient time had elapsed for the

mulched-basin system to produce response in the tree growth. The new leaves on the basined trees were larger and darker in color and had a better texture than those on the unbasined trees, especially on heavy soil. Likewise, the new growth of rootlets was better under the mulch in the basins, and the quality of the fruit on the basined trees was superior to that of the unbasined trees.

The experiments indicate that alfalfa and bean straw are superior to stable manure for mulching purposes. In addition to producing a measurable increase in the humus content of the soils, the use of an organic mulch moderates the rise in soil temperature during the day and aids in conserving moisture.

The authors suggest that surface mulching with organic material, especially when available in quantities sufficient to cover the entire surface, may in the long run prove fully as effective as the use of the mulching material in basins. The mulched basin, however, brings about the incorporation of humus more quickly than organic mulches with furrow irrigation, and it also appears to be the most effective means of using a limited quantity of mulching material.

In view of the successful results in the experimental tracts the mulched-basin system is recommended for experimental consideration by citrus growers as compared with other systems in commercial practice.

The mulch basin system, L. J. Briggs, C. A. Jensen, and J. W. McLane (*Cal. Citrogr., 2 (1917), No. 5, pp. 11, 12, fig. 1*).—A summary of the above.

A humidifier for lemon curing rooms, A. D. Shamel (*U. S. Dept. Agr. Bul. 494 (1917), pp. 10, figs. 7*).—This bulletin describes the plan of work used in conducting humidity studies in some lemon-curing rooms in southern California, summarizes the results noted in a previous paper (E. S. R., 36, p. 741), and describes and illustrates the arrangement and structure of a humidifier invented by the author in 1914 for use in maintaining conditions of uniform humidity in lemon-curing rooms.

The humidifier has been successfully used for two seasons, both for controlling humidity in lemon-curing rooms and for improving air conditions in living rooms in private houses and elsewhere in California.

Shade trees, characteristics, adaptation, diseases, and care, G. E. Stone (*Massachusetts Sta. Bul. 170 (1916), pp. 123–264, figs. 110*).—A practical treatise covering the various questions relative to shade trees and their management and superseding Bulletin 125, previously noted (E. S. R., 20, p. 643), which took up the subject in a general way.

The phases discussed include requirements of shade trees; street and roadside trees; what shall we plant; rapidity of growth of trees; streets and avenues; distance to plant; country roadsides; root characteristics; branching characteristics; soil conditions, texture, etc.; soil covers, lawns, macadam, etc.; excavations, curbings, and sidewalks; effects of light and shade; transplanting; tree surgery; tree guards; fertilizing trees; diseases of trees; winter injuries; drought; sun scorch and bronzing of leaves; mechanical injuries; injurious chemical substances; effects of illuminating gas on trees; effects of atmospheric gases on vegetation; electrical injuries; the spraying of shade trees; valuation of shade trees; court decisions concerning damages to trees; and codified shade tree laws of Massachusetts, 1915.

Fumigation of ornamental greenhouse plants with hydrocyanic acid gas, E. R. Sasscer and A. D. Borden (*U. S. Dept. Agr. Bul. 513 (1917), pp. 20, figs. 4*).—Practical directions are given for fumigating greenhouse plants with hydrocyanic acid gas, including a discussion of the necessary equipment, method of preparing the house and of computing the cubical contents of greenhouses, time for fumigation, chemicals required, methods of mixing the chemicals and

generating gas, ventilation after fumigation, effects of weather conditions on fumigation, the advisability of a fumigation box, cost of fumigation, and precautions. Tables are given showing a large number of ornamentals, including a few tropical and subtropical plants, that have been fumigated by the authors either in greenhouses or in fumigation boxes. The data given include the name of the plant, rate of application, exposure, house temperature, infestation, and results on both plants and insects. The results are for the most part based on the fumigation of commercial houses under commercial conditions.

FORESTRY.

A forest census of Alabama by geographical divisions, R. M. Harper (*Geol. Survey Ala. Monograph 8, Sup. (1916), pp. 208–214, fig. 1*).—This paper, which is supplementary to a previous geographical report on Alabama forests (E. S. R., 29, p. 746), has been noted from another source (E. S. R., 35, p. 748).

Thirteenth annual report of the state forester [of Massachusetts], F. W. Rane (*Ann. Rpt. State Forester Mass., 13 (1916), pp. 124, pls. 6*).—This is the usual annual report relative to the administration and management of the state nurseries and forests in Massachusetts, including also accounts of reforestation work, private cooperative forestry work, utilization of forest products, and fire protection work. Information is also given relative to the present status of the chestnut blight and white pine blister rust and the work of suppressing the gipsy and brown-tail moths.

The present and future of Pennsylvania's forests, S. B. Elliott (*Dubois, Penn.: The Penn. Conserv. Assoc., 1916, pp. 28, pls. 6*).—A summary of the past and present conditions of Pennsylvania forests, together with measures suggested for their restoration and perpetuation.

Tree planting on agricultural estates and roads, T. W. Brown (*Min. Agr. Egypt, Hort. Sect. Leaflet 11 (1917), pp. 65, pls. 8*).—In addition to directions for planting and growing trees descriptions are given of trees found in Egypt.

The Central Provinces forest manual (*Nagpur, India: Govt., 1915, 3. ed., pp. XIII+331*).—A manual on the administration of the state forests in the Central Provinces of India. Part 1 deals with the Indian forest act of 1878 and its application. The succeeding parts deal with the organization of the forest department, constitution of forests, management and working of the forests, and office business.

Note on an inquiry by the government of India into the relation between forests and atmospheric and soil moisture, in India, M. Hill (*[Indian] Forest Bul. 33 (1916), pp. 41, pls. 2*).—This paper summarizes the results of inquiries conducted throughout the Provinces of India since 1906.

Such evidence as is available in India points to the conclusion that the influence of forests probably tends to increase the rainfall, but not in any marked degree. Thus far no satisfactory data have been secured warranting any definite conclusion relative to the influence of forests on the level of the underground water table. In most of the Provinces no serious damage to the flow of rivers had taken place and no great injury had been done to cultivation due to forest denudation. There were several local exceptions to this conclusion in the Punjab, in Bengal, and to a less extent in eastern Bengal and Assam.

Seed selection in the cultivation of Hevea brasiliensis, C. Beadle and H. P. Stevens (*Roy. Bot. Gard. Kew, Bul. Misc. Inform., No. 1 (1917), pp. 19–24*).—In this paper the authors outline a method of procedure for carrying on seed selection investigations with Para rubber.

Ecology of sal (Shorea robusta).—III, Soil aeration and water cultures, R. S. Hole and Puran Singh (*Indian Forest Rec., 5, (1916), No. 4 [pt. 3], pp. 87–102, pls. 4*).—Further experiments relative to the causes of the dying out of sal seedlings (E. S. R., 36, p. 345) led to the conclusion that inferior growth in badly aerated soil is correlated with an accumulation of carbon dioxid or a deficiency of oxygen in the soil, and that poor growth is not due to the presence of excessive water in itself. See also previous notes (E. S. R., 35, p. 649; 36, p. 44).

Our wattles, T. C. Wollaston (*Melbourne and Sydney: Lothian Book Publishing Co., [1917], pp. 76, pls. 12*).—Popular descriptive accounts with illustrations of the Australian wattles (*Acacia* spp.).

Investigations of the rotting of slash in Arkansas, W. H. Long (*U. S. Dept. Agr. Bul. 496 (1917), pp. 14*).—This bulletin reports an investigation of the rapidity with which timber slash or brush rots and of the fungi causing this rotting under each of the methods of pulling, piling, and scattering brush.

When brush is lopped and scattered it rots much more rapidly than when either piled or pulled. None of the main fungi concerned in rotting either oak or pine slash in Arkansas produce heart rots in living trees.

Yields from the destructive distillation of certain hardwoods, II, R. C. Palmer (*U. S. Dept. Agr. Bul. 508 (1917), pp. 8, figs. 2*).—In continuation of a previous report giving the yields from the destructive distillation of a number of hardwoods and of material from different parts of the tree (E. S. R., 32, p. 48) the present bulletin gives the yields for white elm, slippery elm, silver maple, green ash, blue ash, yellow ash, chestnut oak, tanbark oak, California black oak, Louisiana swamp oak, and eucalyptus. The results are deemed of especial interest to the manufacturers of by-products.

Poles purchased, 1915, A. M. McCreight (*U. S. Dept. Agr. Bul. 519 (1917), pp. 4*).—A statistical account of the number of poles purchased during 1915 in the United States by the telephone and telegraph companies, steam and electric railroads, and electric light, heat, and power companies. A total of 4,077,964 poles was reported as purchased during 1915, an increase of 659,944 over 1911, and the largest number reported in any single year.

Handbook on wood preservation (*[Baltimore, Md.]: Amer. Wood-Preservers' Assoc., 1916, pp. V+73*).—A compilation of facts and figures relative to wood preservation. The following subjects are considered: Decay, preparation, and treatment of wood; chronicle of wood preservation; progress in wood preservation; processes for preserving wood; wood preservatives; manufacturers of wood preservatives and wood-preserving equipment; uses and users of preserved wood; wood-preserving plants; American Wood-Preservers' Association; and a bibliography of wood preservation.

DISEASES OF PLANTS.

Transmission of diseases by seeds, L. Blaringhem (*Assoc. Franç. Avanc. Sci., Compt. Rend., 43 (1914), pp. 470–478, fig. 1*).—The author, concluding a discussion of investigations and observations on the transmission of plant diseases and their reappearance, states that there probably exist different varieties of *Althæa rosea* as regards the period of sporulation of Puccinia parasitic thereon. The facts are emphasized that the more obvious stages of disease fungi are not necessarily those in which the disease is transmitted (citing the case of a mycoplasmic stage or one in which seeds, though infected, do not reveal that fact to the eye), and that the duration of the stages of latency or of activity (knowledge of which is necessary to the control of disease) is dominated largely by external conditions. It is thought that the apparent formation of resistant

strains may be the result of the loss of the parasite, giving rise to varieties by a process analogous to regressive mutation, or it may result from the influence of prolonged or severe climatic factors, the parasite in such cases being simply latent during successive generations.

Chemotropic reactions in Rhizopus nigricans, A. H. Graves (*Mem. N. Y. Bot. Gard., 6 (1916), pp. 323–331; Bot. Gaz., 62 (1916), No. 5, pp. 337–369, figs. 4*).—A study of several fungi, mainly *R. nigricans*, has demonstrated a negative chemotropism of the fungi toward their own metabolic products. A much weaker positive chemotropism toward such substances as cane sugar and glucose was noted. This positive response is better in case of turnip juice and may in general be better in plant juices. The facts as noted suggest that the distribution of a parasitic fungus in a plant may be due more to negative chemotropism in regard to its own staling products than to positive chemotropic stimulation.

Discovery of internal telia produced by a species of Cronartium, R. H. Colley (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 9, pp. 329–332, pl. 1*).—The author reports the production of internal telia by *C. ribicola* in the petioles of leaves of species of Ribes. Internal rust sori, four types of which have been found developing in the host plant tissue, are regarded as rather common teratological phenomena.

Discussion of certain plant diseases, J. T. Barrett (*Proc. Fruit Growers' Conv. Cal., 47 (1915), pp. 216–222*).—The participants in this discussion dealt with prune rust (*Puccinia pruni*), two epidemics of which have occurred in southern California in the last two years; apricot scab or black spot, which was serious in at least two sections during the previous year; shot hole, easily confused with scab, but readily controlled with Bordeaux mixture; and brown rot, which is now under investigation.

Report of the department of plant pathology, M. T. Cook et al. (*New Jersey Stas. Rpt. 1915, pp. 365–374*).—In these pages a report is given of the activities of the department in 1915, with a list of the common diseases observed during that time.

[Investigations on plant diseases] (*Wisconsin Sta. Bul. 275 (1917), pp. 35–40, figs. 3*).—Progress accounts are given of investigations of various plant diseases carried on at the station.

In continuation of the work on tobacco diseases, J. Johnson is reported to have carried on studies of inheritance in crosses between resistant and susceptible varieties of tobacco and also of the distribution of the causal organism of tobacco root rot (*Thielavia basicola*). In the latter investigation, he is said to have found 66 new hosts for this fungus.

In studies of inheritance of disease resistance in plants, W. H. Tisdale is investigating wilt resistance in flax and also strains of cabbage resistant to yellows. Resistance to wilt is considered a dominant characteristic in flax, while in case of cabbage resistant to yellows, a greater degree of variability in first generation seed was observed than in case of flax resistant to wilt.

A brief account is given of a bacterial disease of barley, a preliminary note of which has already been given (E. S. R., 35, p. 845).

For the control of barley diseases through seed disinfection, A. G. Johnson reports the successful use of formaldehyde for all of the three important barley diseases, stripe, loose smut, and covered smut, a preliminary account of his investigations having been previously noted (E. S. R., 36, p. 247). In general practice, he recommends controlling the stripe disease by soaking seed for two or three hours in 1 pint of formaldehyde to 20 gal. of water.

The work of G. W. Keitt on the control of cherry leaf spot is briefly outlined, attention being called to the successful use of Bordeaux mixture or lime-sulphur against this disease (E. S. R., 36, p. 149).

[Plant diseases in British Guiana], C. K. BANCROFT (*Rpt. Dept. Sci. and Agr. Brit. Guiana, 1914–15, App. 2, p. 13*).—In the annual report on scientific investigations in the botanic gardens during 1914–15, the author states that the principal diseases affecting imported sugar cane during the year were the leaf spot (*Leptosphæria sacchari*) and leaf sheath spot *Cercospora vaginæ*). Other cane diseases mentioned are the root, or dry disease (*Marasmius sacchari*) and two rind diseases caused respectively by *Trichosphæria sacchari* and *Melanconium sacchari*.

Coconut bud rot, apparently associated with defective drainage or other adverse soil conditions, continued to be prevalent in some localities. Witches' broom disease of cacao has proved to be amenable to treatment by pruning and spraying.

Two new root diseases appeared on one lime plantation, due respectively to *Fomes semitostus* and *Hymenochæte noxia*. Citrus knot was reported from the same plantation. The causation has not been determined, though it may be due to attacks of bird vine (*Loranthus theobromæ*).

Coffee anthracnose (*Colletotrichum* sp.) was largely controlled by repeated spraying with Bordeaux mixture and the destruction of affected leaves and fruits.

The leaf disease of Para rubber mentioned in the report of the previous year (E. S. R., 34, p. 442) has done considerable damage.

Blast of rice, due to *Piricularia oryzæ*, is recorded for the first time, but it is probably not yet widely prevalent.

[Plant diseases in Tasmania], H. M. NICHOLLS (*Agr. and Stock Dept. Tasmania, Rpt. 1915–16, pp. 18–20*).—The annual report of the government microbiologist, besides mentioning some insect pests of plants, gives a brief account of *Armillaria mellea*, causing damage to young apple orchards and apparently benefited by the use of potassium permanganate, picric acid, and iron sulphate on the roots. A Septoglœum, supposed to cause a disease of field peas; *Fusarium oxysporum*, causing wilt disease of potato; Irish blight in some sections; a Fusarium causing leaf wilt and the speedy death of young fruit trees, particularly apple; *Valsa prunastri* and *V. ambiens*, usually on apple trees killed by Fusarium; and mildew of cereals (*Erysiphe graminis*) are also noted. Experiments for the prevention of brown fleck of potatoes are still in progress.

A physiological study of two strains of Fusarium in their causal relation to tuber rot and wilt of potato, G. K. K. LINK (*Nebraska Sta. Research Bul. 9 (1916), pp. 3–45, figs. 13; Bot. Gaz., 62 (1916), No. 3, pp. 169–209, figs. 13*).—An investigation was made of two species of Fusarium occurring on the potato to determine whether there is a sharp biological contrast between the species, as claimed by Wollenweber (E. S. R., 29, p. 444), and if so, to what physiological basis this contrast is to be attributed. As a result of his studies, the author concludes that there is not so sharp a contrast as would be expected from the paper cited.

A detailed account is given of the ecology and physiology of the organisms causing tuber rot and wilt of potato, and it is reported that *F. tuberivorum* (E. S. R., 29, p. 47) and *F. trichothecioides* (E. S. R., 27, p. 650) are identical. Studies of this species and *F. oxysporum* showed that both can produce tuber rot and wilt of the potato plant. Wilt is induced by the destruction of the root system and by clogging the xylem elements in the stem. In mild cases it is characterized by discoloration, curling and rolling of the leaves, production of aerial tubers, etc. Under field and storage conditions *F. oxysporum* is probably more responsible for wilt than is *F. trichothecioides*, while the latter is more responsible for tuber rotting. The biological characters of the different species are described at length.

On the part played by the seed in the dissemination of potato diseases and on the advantages of disinfecting with corrosive sublimate, H. M. Quanjer (*Meded. Rijks Hoogere Land, Tuin en Boschbouwsch.* [*Wageningen*], *9* (*1916*), *No. 2–4, pp. 94–126, pl. 1*).—This is the second contribution to a monograph on potato disease in Holland (E. S. R., 29, p. 347). The quarantine measures employed in the United States are said to have made it necessary to study closely the so-called scab diseases from the standpoint of their distribution and control in Holland.

Common scab (*Actinomyces scabies*) is said to be present in many parts of that country, the fungus being visible for only a little while just after digging as a gray film on the scab spots. In cases where spraying with Bordeaux mixture has retarded the ripening process, the scab spots are deeper and more numerous than when the potatoes are ripened and dug earlier. Powdery scab (*Spongospora subterranea*), though not so widely distributed, is present in many parts of the Netherlands. The canker form is not known in that country. *Hypochnus solani* (*Rhizoctonia solani*) is very common on the tubers, by which it can be transmitted.

Experiments were made testing the protective value for each phase of scab of a 1:1,500 corrosive sublimate solution on low clay land not infected, on high sandy soil infected with *A. scabies* and *R. solani*, and a peaty soil infected with all three diseases, the tabulated results showing the yield of infected or sound tubers and the increase in market value by treatment. It is thought that a 1:1,000 corrosive sublimate solution is preferable (see also below).

On the nature, mode of dissemination, and control of phloëm necrosis (leaf roll) and related diseases, H. M. Quanjer, H. A. A. van der Lek, and J. O. Botjes (*Meded. Rijks Hoogere Land, Tuin en Boschbouwsch.* [*Wageningen*], *10* (*1916*), *pp. 1–162, pls. 12; abs. in Gard. Chron., 3. ser., 60* (*1916*), *No. 1550, p. 124*). This is the third contribution of the series noted above. It deals with the external and the histological features, and the pseudo-hereditary character of leaf roll and with metabolism in the plants affected therewith, the causation, communicability, external influences, prevention, and notes on diseases related to or comparable with leaf roll of potato or other plants, such as potato mosaic and curly dwarf, yellow stripe and sereh of sugar cane, leaf curl of peanut (*Arachis hypogæa*), curly top and mosaic of sugar beet, and cases of infectious chlorosis in various plants.

The phlöem in affected plants shows characteristic changes, which are described and which are summed up in the term necrosis. Apparently it is transmitted by the mother tubers, by grafting sound on affected plants, and vice versa, and it passes into the soil, which remains capable of infecting potato plants for at least two years. Varieties differ in suceptibility. The infecting organism has not yet been discovered and may be ultramicroscopic. The disease is apparently not due primarily to the condition of the plant.

Report of potato spraying experiments for 1915, H. C. Lint (*New Jersey Stas. Rpt. 1915, pp. 381–394, pl. 1*).—Results of cooperative experiments with various fungicides and insecticides for the control of potato diseases and insect pests are given which show that Bordeaux mixture applied to an early crop of potatoes increases the yield. Basing his conclusions on three years' experiments, the author considers that climatic conditions play an important rôle in deciding to what extent the benefits from Bordeaux mixture will be realized. Both homemade and commercial preparations of Bordeaux mixture were found to prolong the life of the vines and to give an average increase of about 45 bu. per acre when applied to second crop potatoes. Early blight is said to have been very prevalent in the plats of the second crop experiment, and it is probable that the control of this disease may account for much of the increase in

yield due to Bordeaux spraying. Bordeaux mixture gave the best control of flea beetles of any of the mixtures applied. Sulphur dust mixtures were somewhat beneficial, but their effectiveness as compared with Bordeaux mixture has not been definitely established. The state of cultivation and the fertility of the field are considered to have an intimate relation to the benefit to be derived from spraying.

Report of potato scab experiments, 1915, H. C. LINT (*New Jersey Stas. Rpt. 1915, pp. 375–381, fig. 1*).—In continuation of previous accounts of the use of sulphur for the prevention of potato scab (E. S. R., 34, p. 155), the author gives the results of further tests to determine the value of sulphur in connection with the control of this disease.

Experiments carried on in a number of localities indicate that in some cases broadcasting the sulphur is more effective than mixing it with fertilizers. In one instance the mixture of sulphur with fertilizers caused considerable injury to the tubers. In another experiment an increased yield was obtained where sulphur was employed. Sulphur was again found to be more effective in combination with potassium chlorid than with potassium sulphate and with acid phosphate than with steamed bone.

In connection with seed treatment with formaldehyde and corrosive sublimate, sulphur was found more effective in controlling scab when used with treated than with nontreated seed. A study of the effect of sulphur applications on succeeding crops showed that no permanent injury to hay crops resulted, and a beneficial effect was observed on potato crops grown on the same land. Two successive applications of 300 lbs. appear to be more effective than one of 600 lbs., and as effective as one of 600 lbs. followed by 300 lbs.

Physiological studies of Bacillus radicicola of soy bean (Soja max) and of factors influencing nodule production, J. K. WILSON (*New York Cornell Sta. Bul. 386 (1917), pp. 367–413, figs. 15*).—The experiments described in this bulletin were undertaken to study the physiology of the causal organism of nodule formation on soy beans and the factors influencing nodule development, the work being carried on in the greenhouse and laboratory. The data obtained are considered to apply to this organism only, although in many respects they agree with those obtained by other investigators working with other strains of *B. radicicola.*

It was found that nodule formation can be checked or stimulated depending on the presence or absence of certain salts and the amount of moisture present. Among the compounds found to stimulate nodule formation are the chlorids, phosphates, calcium-containing compounds, and certain organic carbon-containing compounds, while nitrates, ammonia-containing or ammonia-producing compounds, and sulphates reduced nodule production. In the experiments, an increase in moisture content from 35 to 45 per cent more than doubled the production of nodules, while with an increase from 45 to 55 per cent, it was nearly doubled. The composition of the soil solution is considered an important factor in controlling nodule production.

It is thought that the failure of pure culture work may possibly be explained by the application as fertilizers of inhibiting substances.

A bibliography is appended.

A squash disease caused by Choanephora cucurbitarum, F. A. WOLF (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 9, pp. 319–328, pls. 3*).—In an investigation carried on at the North Carolina Experiment Station, the author found summer squashes attacked by a phycomycetous fungus, *C. cucurbitarum.* A study has been made of the development of the disease and the morphology of the causal organism, the results of which are given in some detail.

The organism was found parasitic on summer squashes, causing a blight of the flowers and a rot of the fruits. The disease has been the cause of very considerable losses. The infection of the fruit is said to occur for the most part by the passage of the fungus from the fading corolla to the young squash. In addition, it is believed that various species of bees and striped and spotted cucumber beetles play some part in disseminating the disease. The fungus has also been found on the flowers of cucumber, althea, okra, cotton, and other malvaceous plants.

Arsenical injury through the bark of fruit trees, D. B. SWINGLE and H. E. MORRIS (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 8, pp. 283–318, pls. 6*).—The authors report a series of investigations carried on at the Montana Experiment Station to determine the possibility of arsenical injury to sprayed fruit trees and the conditions under which injury would occur. Trees were treated with a number of arsenical compounds, the application being made to branches of various sizes, trunks, crowns, and roots.

As a result of their investigations, the authors claim to have established conclusively that arsenical compounds used as insecticides can be made to injure the crowns of trees under conditions very similar to those that result from some orchard practices. It was found that the periderm on the smooth bark of apple trees is practically impervious to arsenical solutions, but that such solutions may be admitted through wounds, lenticels, or latent buds, in which case more or less injury will follow. As the trees become older and the bark rougher the cracks made in its production will admit arsenical solutions to the inner tissues, which will be injured. Roots and branches of equal size and with similar bark are about equally susceptible to arsenical injury. If the injury is rapid, very definite longitudinal streaks will be produced in the bark and sapwood, but if the injury is slow, the streaking is not so evident. Paint applied to fresh wounds offers a partial but not complete protection. The injury caused by arsenical compounds is not necessarily due to impurities they may contain.

Diseases of deciduous fruit trees, R. E. SMITH (*Proc. Fruit Growers' Conv. Cal., 47 (1915), pp. 257–263*).—This includes a discussion of gummosis as an expression of injury, of bad cultural conditions, or of various causes more or less unfavorable to the health of the tree. It also deals with pear blight and its variability and control by vigilance and careful early pruning.

Peach yellows and little peach at Vineland, M. A. BLAKE and C. H. CONNORS (*New Jersey Stas. Rpt. 1915, pp. 51–53, pls. 2*).—A report is given of observations regarding peach yellows and little peach on the peach orchards established at Vineland (E. S. R., 20, p. 1037), one having been planted in 1907, another in 1908, and a third in 1912. From the different orchards, 5.5, 11.8, and 0.8 per cent of the trees, respectively, have been killed by the diseases in question. No varietal difference as to susceptibility to these diseases has been noted. The authors recommend that trees be removed as soon as symptoms of either disease appear. In the experimental orchards no tree planted in a position from which a diseased tree had been removed failed to grow and no replanted tree has become diseased.

Plum pockets, E. RABATÉ (*Vie Agr. et Rurale, 6 (1916), No. 22, pp. 388–391, figs. 7*).—Briefly discussing plum pockets caused by *Exoascus pruni*, the author recommends the removal and destruction of all diseased fruits, and the disinfection of the tree in January with a solution containing 10 per cent of iron sulphate and 2 per cent of copper sulphate, repeating the disinfection after blooming occurs.

Little leaf of the vine, F. T. BIOLETTI and L. BONNET (*U. S. Dept. Agr., Jour. Agr. Research, 8 (1917), No. 10, pp. 381–398, pls. 4, figs. 2*).—In a contribution from the California Experiment Station the authors describe a disease of

the vine variously known as little leaf, curly leaf, and yellow leaf. This disease is known to have been present in California for a number of years, although no printed reference to it has been found that points clearly to its occurrence before 1900. At the present time, it is said to attack vines in various regions from the borders of Sacramento and San Joaquin Counties to the southerly end of the San Joaquin Valley. In seriousness it is to be compared with Oïdium and phylloxera.

Affected vines show small, yellowish leaves, short jointed canes, and in severe cases, dead spots on the leaves and gummy secretions in the conducting tissues of the arms and trunks. In severe cases the vines die after a few years. No parasite has been found connected with the disease, and all the evidence seems to show that it is not infectious. The trouble is believed to be associated with local conditions of soil, water, and temperature. No effective method of treatment has been demonstrated, although the application of gypsum to the soil is said to have given promising results.

Control of Oïdium or vine mildew, F. T. Bioletti (*Proc. Fruit Growers' Conv. Cal., 47 (1915), pp. 147–154*).—This is a paper by the author with the discussion thereon.

It is stated that during 1915 attacks of Oïdium have been exceptionally widespread and destructive. The damage was particularly intense in the interior and in regions where it is usually mild or unknown, rather than in those sections where it is always present. The unusual severity this year is ascribed to weather conditions. Finely powdered sulphur, applied while the leaves are dry, is recommended. Winter treatments are believed to be ineffective.

The spraying of yellow pineapple plants on manganese soils with iron sulphate solutions, M. O. Johnson (*Hawaii Sta. Press Bul. 51 (1916), pp. 11, figs. 4*).—The yellowing of pineapples on the black manganese soils of the island of Oahu is said to present a serious problem. Previous work of the station (E. S. R., 27, p. 129) had shown that this yellowing is correlated with the presence of abnormally large quantities of manganese in the soils.

The author gives an account of experiments for the control of the pineapple yellows by spraying the plants with an 8 per cent solution of iron sulphate. This can be done at a cost for each application of approximately 60 cts. per acre. In a field trial, the rows sprayed with the iron sulphate solution produced more than double the weight of fruit produced by the check rows, while a still greater increase was noted in the proportion of first-grade fruits.

As a result of his investigations, the author recommends spraying plants with the solution described above when there are any indications of yellowing, repeating the spraying often enough to keep the plants in a green and healthy condition.

Citrus canker investigations at the Singalong Experiment Station, E. D. Doryland (*Philippine Agr. Rev. [English Ed.], 9 (1916), No. 2, pp. 133–135*).—Bordeaux mixture having failed to control citrus canker on badly infected nursery stock of *C. mitis*, *C. nobilis*, and *C. aurantium* in 1915, tests were made with 1 part 38 per cent formaldehyde in 120 parts of water and later with a 1 : 100 solution applied to the plants and soil, combined with the removal of the infected leaves and severe pruning. The disease was checked and a healthy growth resulted, subsequent outbreaks of the disease being attributed to the release of infecting material by the turning of the soil. The outbreaks were readily controlled by the use of the same treatment, no new infections being apparent at the time of the report.

Further tests with formalin sprays are being made at both the Singalong and the Lamao stations.

Notes on the citrus canker, P. J. WESTER (*Philippine Agr. Rev.* [*English Ed.*], *9* (*1916*), *No. 2*, *pp. 155–157*).—It is stated that the author first saw citrus canker in the Philippines in 1912 at the Lamao Station, but that he then considered it a virulent form of scab. Though present ever since that time, it caused no serious trouble until after the rainy season of 1914. An account is given of the localities in which it has been noted. What is thought to be citrus canker has been discovered on 22 species or varieties of Citrus in the Philippines as here listed. *C. nobilis*, *C. nobilis papillaris*, *C. mitis*, and *C. webberii montana* appear to be practically immune, *C. aurantium* and *C. decumana* very variable, and a few named are particularly susceptible to citrus canker. The disease is generally most destructive when the plants are less than a meter in height.

In 1915, the disease was noted in eastern and western Java and in Singapore. This fact, its occurrence in the Philippines on some of the most primitive Citrus forms, as well as on the native taboc, and its prevalence in China and Japan suggest that the citrus canker may be widespread in Malaysia and perhaps in Indian and Ceylon.

Diseases of the lime tree, J. B. HARRISON, C. K. BANCROFT, and G. E. BODKIN (*Jour. Bd. Agr. Brit. Guiana*, *9* (*1916*), *No. 3*, *pp. 122–126*).—In this report, which deals also with insect pests of limes, mention is made of leaf yellowing, ascribed to soil conditions; staghead, due to constant winds; citrus knot, usually associated here with *Loranthus theobromæ;* gummosis, connected with adverse soil conditions; withertip, leaf spot, or anthracnose, caused by *Colletotrichum glœosporioides;* sooty mold, consisting of the nonparasitic but injurious *Capnodium citricolum;* a root invasion by *Fomes semitostus;* a brown root disease, caused by *Hymenochæte noxia;* lichens on trunks and leaves; and bird vine (*L. theobromæ*).

A Phoma disease of lavender, W. B. BRIERLEY (*Roy. Bot. Gard. Kew, Bul. Misc. Inform.*, *No. 5* (*1916*), *pp. 113–131*, *pls. 2*, *figs. 9*).—A serious disease of Lavandula, apparently confined to this genus, is due to *P. lavandulæ*, which is here, supposedly for the first time, recorded for England, with an account of a study made by the author on the characters and habits of the causal organism. The mycelium ramifies throughout the tissues of the host, causing collapse of the cortex and phloem groups, the hyphæ passing from cell to cell through the abundant pits in the cell walls. The pycnidia form below the epidermis which is thus lifted from the cortex. Chlamydospores are occasionally formed, but conidia have not been known to occur in the normal life cycle.

The extension of Marsonia rosæ on rose bushes, J. CHIFFLOT (*Assoc. Franç. Avanc. Sci., Compt. Rend.*, *43* (*1914*), *pp. 426–428*).—It is stated that *M. rosæ*, formerly confining its attacks to the foliage, may, in case of certain varieties, extend itself to all the aerial portions of the plant.

Roesleria pallida, JESSIE S. BAYLISS-ELLIOTT and W. B. GROVE (*Ann. Bot.* [*London*], *30* (*1916*), *No. 119*, *pp. 407–414*, *figs. 11*).—The authors have made a study of a fungus growing on the roots of a willow which had died at the end of the autumn, 1915, after passing through a period of gradual exhaustion. The fungus supposed to be the cause of the trouble and at first thought to be *Pilacre petersii* was carefully studied in connection with others supposedly related thereto.

It is stated that the fungus in question proved to be *R. pallida*, which is described, as existing descriptions are considered to require important modifications. It is thought that Pilacre is probably a conidial stage of species of Roesleria (*R. pilacriformis* being only a slender form of *R. pallida* and *P. petersii* being identical with *P. faginea*). These species of Pilacre are con-

idiophorous, not basidiophorous, and are not connected with the Auricularieæ or the Tremellineæ.

[Hevea dieback in Sumatra], J. G. C. Vriens (*Meded. Adv. Alg. Ver. Rubberplanters Oostkust Sumatra, No. 2 (1915), pp. 19–21; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 12, pp. 1706, 1707*).—The serious diseases of Hevea in Sumatra are said to be those due to *Fomes semitostus*, *Phytophthora faberi*, *Corticium salmonicolor*, *Hymenochæte noxia*, and *Thyridaria tarda* (*Botryodiplodia theobromæ*). The last named fungus is the cause of a dieback which is described. The trees may recover if the weather is dry and favorable, but attack on the trunk is liable to be followed by the death of the tree and the spread of the disease to neighboring trees. The disease is said to be controllable by spreading tar on the infected spots and, as soon as this is dry, cutting out and burning the tarred spots.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A history of British mammals, G. E. H. Barrett-Hamilton and M. A. C. Hinton (*London: Gurney & Jackson, 1916, vol. 2, pt. 19, pp. 601–648, pls. 2, figs. 4*).—This continuation of the Muridæ (E. S. R., 35, p. 656) deals with the genus Epimys, including the tree or roof rat (*E. rattus frugivorus*) and the brown or common rat (*E. norvegicus*); and the genus Mus, including the house mouse (*M. musculus*).

Gopher destruction, J. H. Grisdale (*Canada Expt. Farms Bul. 31, 2. ser. (1916), pp. 8, figs. 4*).—This describes methods of combating gophers, which are among the worst enemies of the farmer on the prairies in the Provinces of Manitoba, Saskatchewan, and Alberta.

The control of voles in Italy, A. Splendore (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 25 (1916), II, Nos. 1, pp. 46–49; 6, pp. 218–224; 12, pp. 516–521; abs. in Nature [London], 98 (1916), No. 2461, p. 338*).—This is a report of work carried out at the entomological laboratory of the University of Rome with a view to finding some satisfactory method of controlling voles (*Pitymys savi*), an outbreak of which in the Province of Foggia in Apulia during the summer resulted in an almost entire destruction of the grain crop.

A spontaneous outbreak of a disease among voles sent the author for study resulted in the death of a number en route, while the remainder died a few days after their arrival in Rome. In all of these voles a coccobacillus was present in the blood, the internal organs, and the lymphatic glands. There was a remarkably high mortality among voles in the vicinity of Cerignola. The epizootic, which spread extensively, presented the features of a septicemia, the internal organs being congested, especially the spleen and liver, which were always enlarged. A comparison of the coccobacillus with *Bacillus typhi murium* and the typhi-coli group shows it to represent a new species which he describes as *Bacterium pitymysi*.

Voles obtained from a locality where the epizootic was not known to occur died in less than 24 hours after subcutaneous inoculation with an emulsion of the spleen or liver of an infected vole, while others fed with infected material died in three or four days. When dead or infected voles were placed among healthy ones, the latter developed the disease in a few days, and it was also pathogenic for mice, rats, and rabbits.

The organism was isolated from the intestine of fleas found on an infected vole, and the injection into a healthy vole of the intestinal contents of three such fleas resulted in its death in less than 24 hours. Another healthy vole placed in a vessel with three vole fleas died three days later. Both voles were

found to exhibit the usual congestion of the internal organs and to contain the coccobacillus. The author considers the experiments to confirm his previous suspicion that the fleas serve as the natural method of transmission. He recommends that voles infected by inoculation be distributed in the areas invaded by voles, where the epizootic has not yet appeared, so that the disease will be propagated by fleas and continually extend until the areas are freed from the rodents.

Destruction of oysters by crabs, J. NELSON (*New Jersey Stas. Rpt. 1915, pp. 249–251*).—Observations have led to the conclusion that crabs are a source of destruction of oysters, though it is possible that some other enemy destroys the oyster and that the crab cleans out the dead meat. Observations extending over many months have failed to show that living water fleas, snail larvæ, worm larvæ, etc., swallow oyster fry. One very abundant copepod, thought to be a species of Calanus, is, however, suspected of feeding on oyster fry.

Insect enemies, C. A. EALAND (*London: Grant Richards Ltd., 1916, pp. XIII+223, pls. 23*).—In this work the author enumerates the life histories and destructive habits of a number of important British injurious insects, and gives descriptions enabling them to be recognized and methods by means of which they may be held in check.

Mushroom pests and how to control them, C. H. POPENOE (*U. S. Dept. Agr., Farmers' Bul. 789 (1917), pp. 13, figs. 7*).—A revision of Bureau of Entomology Circular 155, previously noted (E. S. R., 27, p. 657).

Pests of sugar cane in British Guiana, J. C. HUTSON (*Agr. News [Barbados], 15 (1916), Nos. 382, pp. 410, 411; 383, pp. 426, 427*).—This is a review of the reports by H. W. B. Moore on the insect pests for the years 1914 and 1915, which relate entirely to the enemies of sugar cane in British Guiana and their control.

General report on insect pests for the year 1915, H. W. B. MOORE (*Demerara, Brit. Guiana: The Argosy Co., Ltd. [1916], pp. 8*).—Noted above.

Some new or little-known enemies of fruit trees, N. A. KEMNER (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 133 (1916), pp. 21, figs. 12; K. Landtbr. Akad. Handl. och Tidskr., 55 (1916), No. 5, pp. 413–429, figs. 12; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 8, p. 354*).—This paper deals particularly with the shot hole borer, *Magdalis pruni* (*ruficornis*) which occurs in company with the shot hole borer, and *Anobium rufipes*, which is attacked by a braconid (*Hecabolus sulcatus*). A key to the insects attacking the branches and trunks of fruit trees, according to the nature of the injury, is appended to the paper, as is a list of 37 references to the literature.

Insects injurious to pine and fir trees in Sweden, I. TRÄGÅRDH (*Skogsvårdsför. Tidskr., 13 (1915), No. 11, pp. 813–874, figs. 49; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 3, pp. 464, 465*).—An account of the Microlepidoptera injurious to pine and fir trees in Sweden, with a list of references to the literature.

Measures for avoidance and extermination of flies, mosquitoes, lice, and other vermin, H. MAXWELL-LEFROY (*Calcutta and Simla: Thacker, Spink & Co., 1916, 2. ed., pp. 17, figs. 5*).—This second edition of the paper first issued in 1915 gives simple instructions for avoiding the attacks of disease-carrying insects and for their extermination. It includes new methods devised during the latter half of 1915 and used by the army in France and the Mediterranean region, together with information especially applicable to India.

Twenty-ninth report of the state entomologist on the noxious and beneficial insects of the State of Illinois, S. A. FORBES (*Rpt. State Ent. Ill., 29 (1916), pp. IX+127, pl. 1, figs. 24*).—This report consists of a number of papers all of which, with the exception of one, On the Life History of the Codling

Moth, by S. A. Forbes and P. A. Glenn (pp. 1–21), are by the author and have been previously noted, namely, A General Survey of the Maybeetles (Phyllophaga) of Illinois (pp. 23–65) (E. S. R., 35, p. 158); The Influence of Trees and Crops on Injury by White Grubs (pp. 66–70) (E. S. R., 35, p. 159); and The Chinch Bug Outbreak of 1910 to 1915 (pp. 71–127) (E. S. R., 36, p. 153).

The paper relating to the codling moth gives the main practical results of work in 1915 in addition to the information given in the paper previously noted (E. S. R., 34, p. 251). The data obtained concerning both insects and weather have been brought together in two diagrams. There were found to be two complete generations of the codling moth in both central and southern Illinois during 1915, and a small or partial third generation at Olney and farther south.

It is found that the temperature of the season has very much to do with the rate at which the successive changes go on, the time at which the different generations make their appearance, reach their largest numbers and disappear, and with the size and importance of the last or third generation of the year. It is pointed out that 1914, when a total failure to control the pest resulted in some orchards notwithstanding the fact that sprays had been applied six, and in some cases seven times, was a very different year from 1915 throughout southern Illinois, not only in respect to temperature and other weather conditions but also in the number and importance of the last generation of the codling moth.

The authors are convinced that the successful timing of spraying operations to the life history of the insect so that effective poisons may be on the apples when they are most needed and will be most destructive to the young apple worms requires a careful and intelligent observation of the course of events for each year. They believe that for the best results a well-equipped observation station with an experienced man in charge is necessary for each of the principal fruit sections of the State, but propose a practical method by which the fruit grower can himself follow the course of events through the season in a way to serve fairly well the necessities of the case, enabling him to learn for himself and for the fruit growers in his region about when spraying should be done and how often repeated to protect his crop.

Entomological report for 1915, E. N. Cory (*Rpt. Md. State Hort. Soc., 18 (1915), pp. 151–163*).—This reports briefly upon the occurrence of the more important insects in Maryland during 1915.

Report of the department of entomology, T. J. Headlee (*New Jersey Stas. Rpt. 1915, pp. 297–335*).—The several parts of this report include a tabular statement of the insects and other animals about which correspondents have written; the occurrence of the more important insects of the year, including the tent caterpillar, apple and other plant lice, pear psylla, white grub, the rose-chafer, flea-beetles, army worm, Angoumois grain moth, the European pine shoot moth (*Evetria buoliana*), the European mole cricket (*Gryllotalpa gryllotalpa*), etc.; and investigations.

Control work was carried on with the mushroom spring-tail (*Achoreutes armatum*), which was a source of injury at Irvington. Carbon bisulphid was found to destroy the spring-tails, but its use resulted in such serious injury to the mushrooms that it can not be considered as a remedy. In control work with white grubs it appears that the minimum dose of carbon bisulphid on red shale soil is not far from 0.75 oz. to the square foot. Even when used much stronger up to November 1 there was no trace of injury to either blue grass or clover on any of the plats, indicating that the minimum dosage for the grub is well below the maximum dosage for blue grass and white clover. In the control of the rose-chafer on apple self-boiled lime-sulphur plus lead arsenate was the

most effective, giving almost perfect protection. Since no dead beetles were found under the trees treated with self-boiled lime-sulphur it seems probable that the mixture acted purely as a repellent and that lead arsenate had little or nothing to do with the result. In experiments with the potato flea-beetle a mixture consisting of 1 lb. of pyrethrum, 10 gal. of water, and 10 oz. whale-oil soap was effective, but its cost was practically prohibitive. Plants given four treatments with home-mixed Bordeaux (5:5:50) showed 50 per cent reduction in the beetles' work.

In observations of the hibernation of the strawberry weevil this pest was found in woodlands adjacent to strawberry patches in abundance on moss stems (*Dicranum scoparium*) about 0.25 in. below the summits. As recorded in a circular previously noted (E. S. R., 35, p. 364), a mixture of powdered arsenate of lead and sulphur gave better protection than any of the other substances tried, and a mixture composed of one part of the lead to one part of sulphur was a little the more effective. It appears, however, that it is neither the arsenate of lead alone nor the sulphur by itself which is effective, but the mixture of the two.

In the work with the peach borer neither the Scott protectors nor the asphalt coatings gave satisfactory results, due to incompleteness of the covering. In investigation of the effect of moisture upon lethal high temperature the bean weevil (*Bruchus obtectus*) was experimented with, and a few tests made with the pea weevil (*B. pisorum*). It was found that a difference of from 92 to 94 per cent relative humidity has practically no effect upon the lethal temperature for the unprotected bean weevil. Large increases in relative humidity, as from 94 to 96 per cent, have less influence on the lethal temperature than has a change of 5° F.

The report concludes with a discussion of potato dusting and spraying experiments in continuation of those of the previous year (E. S. R., 34, p. 158). In the work with the regular crop there was found to be very little difference between the cost of dusting and spraying, except when an arsenical was used by itself. While the returns from sulphur zinc and sulphur lead were not as large as those from home-mixed Bordeaux, they are considered to have been good. In the work with the second crop the differences between yields from zinc sulphur and lead sulphur on the one hand and lead arsenate alone on the other in the control of the Colorado potato beetle were easily within the limits of experimental error.

[Entomological investigations] (*New Jersey Stas. Bul. 298* (*1916*), *pp. 33–38*).—This is a brief report of investigations on the influence of atmospheric moisture upon insect metabolism; methods of controlling the strawberry weevil, apple aphis, false cabbage aphis, and pear psylla; the efficiency of certain types of covers for wintering bees; the food preference of the common house fly; and the problems connected with mosquito control.

Thirty-first report of the state entomologist on injurious and other insects of the State of New York, 1915, E. P. Felt (*N. Y. State Mus. Bul. 186* (*1916*), *pp. 215, pls. 18, figs. 39*).—A brief statement of the occurrence of the more important injurious insects, the work of the office, etc., is followed by a report of observations and work with the more important pests.

Work with the codling moth (E. S. R., 33, p. 252), was continued, spraying experiments in Albion, Monroe, and Niagara counties being reported upon at length, together with observations of the leaf roller made during these experiments. Much of the data is presented in tabular form. A general survey of conditions in the apple belt in the western part of the State has shown that some growers are able to obtain practically worm-free apples by one spraying for

the codling moth, others with two or three applications, while many suffer great losses in spite of frequent and apparently thorough treatments. It is pointed out that the first spraying made just after blossoming is by far the most effective application. It is thought that the second spray will be most effective in reducing side injury if made the latter part of June, but so far as checking the pest is concerned it does not seem to be essential. "Both the second and third sprayings for the codling moth, even if they have comparatively little influence in reducing the numbers of this pest, are abundantly justified in localities where scab is more or less prevalent, assuming, of course, that a fungicide is universally added to the poisoned spray."

Other important species considered are the chrysanthemum midge (*Diarthronomyia hypogæa*), which was a source of injury at Adrian, Mich., etc.; white grubs, a serious outbreak of which occurred in southern Rensselaer and northern Columbia counties; grasshoppers, investigations of which were continued in Fulton and Saratoga counties; and mosquitoes, the control of which was undertaken in cooperation with the Sodus Bay Improvement Association. A report of biological observations of various mosquitoes by the author and H. H. Stage follows, and an account is then given of oil injuries to the bark of deciduous trees resulting from the use of an oil compound in combating the hickory bark beetle, lined chestnut borer, etc. In an experimental test of an oily preparation, widely recommended under a trade name, upon various forest trees with diameters of 1 to 2 in., six out of ten trees died within six months and the others showed signs of serious injury.

Under the heading of Notes for the Year, fruit tree insects mentioned include the apple maggot, which is becoming abundant in some fruit-growing sections in the Hudson Valley; the red bug (*Heterocordylus malinus*) and the lined red bug (*Lygidea mendax*), both of which are widely distributed in the Hudson Valley, practical work in the control of which during the summer demonstrated the efficacy of a tobacco extract application just before the blossoms open; the San José scale, which was less abundant in the Hudson Valley, due to natural agents, including small parasites; the sinuate pear tree borer, which is extending its range from New Jersey into New York State; the pear thrips, the depredations of which were especially severe in the Hudson Valley owing to weather conditions favorable to its activities; the pear psylla; the quince curculio; and the cherry leaf beetle (*Galerucella cavicollis*), which appeared in large numbers in widely scattered localities and fed upon cherry and peach tree foliage, but without serious damage to the trees. Forest tree insects mentioned are the white-pine weevil (*Pissodes strobi*); ugly nest cherry worm (*Archips cerasivorana*); another pine twig borer *Dioryctria abietella*, which was found working in the buds of Austrian pine at Rochester; the periodical cicada, a scattering infestation of which was reported in the Hudson Valley; and the recently established bayonet or post-horn pine borer which bids fair to become a serious enemy of the native pines. The grass webworm (*Crambus luteolellus*), the lined spittle insect (*Philænus lineatus*), and the European spittle insect (*P. spumarius*) were injurious to grasses.

Lists of the publications of the entomologist and of the more important additions to collections, October 16, 1914 to October 15, 1915, are also given. Part 4 of A Study of Gall Midges (E. S. R., 34, p. 752), which deals with the tribe Asphondyliariæ, is appended.

[Report of entomological investigations] (*Wisconsin Sta. Bul. 275* (*1917*), *pp. 46–49, figs. 5*).—In work with the codling moth on apple, excellent control was secured from the use of powdered arsenate of lead at the rate of 1.5 lbs. to 50 gal. of spray in four applications known as the "pink," "calyx," "second moth," and "summer" sprays. Brief reference is made to improved methods of

rearing queen bees, the results of two seasons' work showing that successful queen production is practically assured. Studies were made of the banded apple aphis, commonly known as the grain or oat aphis, which is the common plant louse on apples in Wisconsin. Experiments in several orchards have shown that it is impossible to control this pest through the use of blackleaf 40 at a strength of 1 to 3,000.

Notes on early stages and life history of the earwig (Forficula auricularia), T. A. CHAPMAN (*Ent. Rec. and Jour. Variation, 29 (1917), No. 2, pp. 25–30, pls. 3*).—This paper presents observations on the biology of this earwig.

Combating Schistocerca peregrina in Morocco in 1916 by the biological method, H. VELU (*Bul. Soc. Path. Exot., 9 (1916), No. 9, pp. 682–684*).—A report of work carried on in continuation of that previously noted (E. S. R., 36, p. 755).

Calocoris angustatus, E. BALLARD (*Agr. Research Inst. Pusa Bul. 58 (1916), pp. 8, pl. 1, fig. 1*).—An account of the life history and of control measures for this capsid, which is a serious enemy of *Andropogon sorghum* all over southern India.

The rose leaf hopper (Typhlocyba rosæ) and a new egg parasite of it, A. TULLGREN (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 132 (1916), pp. 13, figs. 7; K. Landtbr. Akad. Handl. och Tidskr., 55 (1916), No. 5, pp. 404–412, figs. 7; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 8, p. 353*).—*T. rosæ*, a well-known pest of roses, is widely distributed in Sweden, occurring wherever its native food plant, the wild briar, is found. The eggs are parasitized by a mymarid (*Anagrus bartheli*), here described as new.

Solubility of the scale of Lepidosaphes ulmi, S. MAULIK (*Bul. Ent. Research, 7 (1917), No. 3, pp. 267–269, fig. 1*).—The author concludes that the scale of this coccid is probably not a wax and that the ingredients of the spraying fluids in use have no solvent action on the scale. Thus any good results obtained with these fluids depend on the physical properties of the paraffin oil contained in them. "Scrubbing the trunks with a hard brush and hot water in winter, and then spraying with weak kerosene emulsion in the following spring only those trees which show newly-hatched insects on them are better methods of checking the spread of the oyster-shell scale."

Simon's hot-air machine for the treatment of cotton seed against pink bollworm, G. STOREY (*Min. Agr. Egypt, Tech. and Sci. Serv. Bul. 11 (1916), pp. 7; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 12, p. 491*).—A description is given of a machine of the type used in England for drying malt, which was tested to determine its suitability for treatment of cotton seed infested by the pink bollworm. The optimum temperature for this machine seems to lie between 131 and 133° F., but at all temperatures tested a small percentage of the larvæ survived and a small percentage of the seed was damaged. It is concluded, however, that the machine will fulfill all practical requirements. The details of the experiment are reported in tables.

Peach borer observations at Vineland, M. A. BLAKE and C. H. CONNORS (*New Jersey Stas. Rpt. 1915, pp. 48–51, pl. 1*).—The observations here reported are based upon records kept of the number of borers removed annually from each tree in the experimental orchard at Vineland, in continuation of observations of 1913 and 1914 previously noted (E. S. R., 34, p. 161).

The authors' observations refute the quite general belief that the borer works in the roots at no great depth from the surface of the ground, since many small borers were found in the large side roots many inches below the surface in a tree dug up which contained 72 borers. Thus it appears to be extremely doubtful if more than a small proportion of the borers in badly infested trees

are destroyed by examination of the trunk to a depth of from 8 to 10 in. A diagram gives the plans of three orchards and indicates the number of borers removed from each tree during 1915.

It appears that there has been an increase each year in the number of borers found in the trees in spite of thorough work in borer removal. Records kept of the 675 trees of orchard No. 1 show that in 1913 about one-half of the trees contained borers, whereas in 1915 nearly 75 per cent contained borers. In orchard No. 2 there was a decrease in both the number of trees infested and in the total infestation, while in orchard No. 3 there was an increase from 1913 to 1915 of over 63 per cent in the number of trees infested and an increase of more than 125 per cent in the number of borers removed.

A codling moth trap, E. H. Siegler (*Jour. Econ. Ent., 9 (1916), No. 6, pp. 517–521, pl. 1*).—Failure to control the codling moth in the Grand Valley of Colorado, notwithstanding the fact that from five to eight thorough spray applications were made, led to the use of the trap here described, which consists of a strip of wire screen cloth 6 in. in width and sufficiently long to encircle the trunk of the tree. It is based upon the knowledge that the codling moth larva will enter an opening through which, after its transformation, the adult can not escape. In preliminary experiments reported 41 per cent of the larvæ cocooned within the traps.

The effect of cold upon malaria parasites in the mosquito host, W. V. King (*Jour. Expt. Med., 25 (1917), No. 3, pp. 495–498, pls. 2*).—In continuation of investigations of malarial parasites in the mosquito (E. S. R., 35, p. 360) the author reports upon work conducted at New Orleans from September to December, 1916.

The experiments here reported show that the parasite of tertian malaria in the mosquito host is able to survive exposure to a temperature of 30° F. for a period of two days, or 31° for four days, and a mean temperature of 46° for 17 days. In a smaller series of tests the sporonts of the estivo-autumnal parasite have shown a resistance to temperatures as low as 35° for 24 hours.

Report on mosquito work for 1915, T. J. Headlee (*New Jersey Stas. Rpt. 1915, pp. 339–364*).—A detailed report of the work of the year in the control of salt marsh mosquitoes, assistance rendered boards of health and county commissions in mosquito extermination, etc., and brief observations on the mosquitoes of the year.

On the biology of two tachinids which have an intramuscular stage (Plagia trepida and Sturmia scutellata), W. R. Thompson (*Compt. Rend. Soc. Biol. [Paris], 78 (1915), No. 20, pp. 717–721, figs. 5; abs. in Jour. Roy. Micros. Soc., No. 4 (1916), p. 377*).—The eggs of Plagia containing larvæ ready to hatch out are deposited on the body of the host. Upon emerging, the larva traverses the skin and after entering the general cavity passes into a muscle where it remains to the end of the primary stage. It then forms a secondary tegumentary air hole in connection with which it passes the second and third stages, but leaves the host before pupation.

The eggs of Sturmia are deposited on leaves which form the food of the host. Upon being devoured by a caterpillar they hatch in the alimentary canal and the larvæ pass out into the general cavity and thence into a muscle.

Sarcophaga froggatti, n. sp.—A new sheep maggot fly, F. H. Taylor (*Bul. Ent. Research, 7 (1917), No. 3, p. 265*).—Under the name *S. froggatti* the author describes a new sarcophagid found to attack sheep at Winton, Queensland.

On the life history and structure of Telephorus lituratus, Olga G. M. Payne (*Jour. Zool. Research, 1 (1916), No. 1, pp. 4–32, pls. 2, figs. 18; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 8, pp. 321, 322*).—This is a report of studies

at Manchester, England, of the malacoderm beetle *T. lituratus*. The larvæ were found among and below the roots of grass at a depth of about 2 in., but were more abundant near the roots of trees, especially elder and rhododendron. It appears that the larvæ are primarily carnivorous, but whether they are beneficial is doubtful.

Notes on the twelve-spotted cucumber beetle, R. A. SELL (*Jour. Econ. Ent., 9 (1916), No. 6, pp. 551–556*).—These notes relate to the biology of *Diabrotica duodecim-punctata*, which is becoming more numerous in southern Texas.

The rose flea-beetle (Haltica probata), G. F. MOZNETTE (*Jour. Ent. and Zool., 9 (1917), No. 1, pp. 13–19, figs. 7*).—A brief account is given of the seasonal life history and habits of *H. probata*, to which, in a review of the literature, the author has failed to find more than a brief reference. This species has been reported from Spokane, Wash., and Nelson, B. C., attacking the strawberry, and at various times has been reported as feeding on cultivated crops in Oregon. It is distributed along the Pacific coast from British Columbia to California, and there appears to be some possibility of its becoming destructive to cultivated roses.

Observations on its life history and habits are given, together with technical descriptions of its several stages.

Otiorhynchus sulcatus, an enemy of pot plants, N. A. KEMNER (*Trädgården [Stockholm], No. 18 (1916), p. 145, figs. 2; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 8, pp. 354, 355*).—The larvæ of this weevil are often introduced into pots with soil from infested greenhouses, and instances are known where as many as 20 larvæ have been found in one pot. The adults damage the leaves of various plants, especially ferns, rhododendrons, orchids, etc. The injury to the roots by the larvæ, though much more serious, is often overlooked.

The leaf weevil (Polydrusus impressifrons) in New York, P. J. PARROTT and H. GLASGOW (*Ann. Rpt. Ent. Soc. Ontario, 46 (1915), pp. 60–65*).—The leaf weevil, preliminary studies of which are reported, is a new and, until the inception of this study, an unrecorded enemy of shade and fruit trees in this country, brief reference to which has been previously noted (E. S. R., 29 p. 252). Its range in New York State has not been definitely established, but it is known to have become established in Ontario, Monroe, and Wayne counties, and to occur in scattering numbers as far west as Albion, in Orleans County. The damage which it causes is due to nibbling the unfolding buds and then attacking the foliage, preferring the margins of the leaves. Where sufficiently abundant to warrant their use, it is thought that arsenicals will control it.

Notes on the control of the white pine weevil, S. A. GRAHAM (*Jour. Econ. Ent., 9 (1916), No. 6, pp. 549–551*).—During the season of 1916 the author applied different materials at various strengths to young pine trees in an effort to control *Pissodes strobi*. Of the materials used, none but creosote and carbolineum proved effective. The results seem to warrant a further trial of these two materials and also Tanglefoot, which was applied to 40 trees, on a larger scale.

An Indian ant introduced into the United States, W. M. WHEELER (*Jour. Econ. Ent., 9 (1916), No. 6, pp. 566–569, fig. 1*).—This paper records the collection of *Triglyphothrix striatidens* at Audubon Park, La., in August, 1913, and gives a description and drawing of it and a review of its literature.

Two new genera of North American Entedoninæ (chalcid flies), A. A. GIRAULT (*Canad. Ent., 49 (1917), No. 3, pp. 110, 111*).—The genera Elachertodomyia and Emersonopsis are erected.

The privet mite in the South, E. A. MCGREGOR (*Jour. Econ. Ent., 9 (1916), No. 6, pp. 556–561, pl. 1, fig. 1*).—This paper relates to *Tenuipalpus bioculatus*

which appears to be confined to seven southeastern States from North Carolina to Louisiana, inclusive. Tests of insecticides showed that both lime-sulphur and potassium sulphid caused a mortality of 99 per cent, whereas nicotin sulphate destroyed less than 5 per cent.

Contribution to the knowledge of the life history and habits of Tychius 5-punctatus, G. Grandi (*Bol. Lab. Zool. Gen. e Agr. R. Scuola Sup. Agr. Portici, 10 (1915), pp. 103–119, figs. 6*).—Injury caused by this weevil to beans in the commune of Ruvo di Puglia, Italy, led to the studies here reported.

FOODS—HUMAN NUTRITION.

Digestibility of some vegetable fats, C. F. Langworthy and A. D. Holmes (*U. S. Dept. Agr. Bul. 505 (1917), pp. 20*).—Employing the same methods as those used in earlier work in the study of the digestibility of animal fats (E. S. R., 34, p. 364), the authors report the results of a study of the digestibility of vegetable fats, viz, cottonseed. peanut, coconut, and sesame oils, and coco butter. These fats were incorporated in blancmange or cornstarch pudding, which was given with a basal ration of wheat biscuits, oranges, sugar. and tea or coffee. Normal young men served as subjects of the experiments. The following quotations are from the authors' conclusions:

"With allowance for metabolic products, the coefficients of digestibility have been found to be for olive oil, 97.8; for cottonseed oil, 97.8; for peanut oil, 98.3; for coconut oil, 97.9; for sesame oil, 98; for cocoa butter, 94.9 per cent. These values indicate that the vegetable fats studied, with the exception of cocoa butter, have for all practical purposes the same digestibility and are utilized as completely as the animal fats.

"The melting points of these fats are considerably lower than body temperature (37° C.), and in accordance with the theory that fats of low-melting points are more thoroughly digested than the harder fats, it has been found that the vegetable fats studied, with the exception of cocoa butter, are utilized practically completely by the body.

"The average amounts of fat eaten per subject daily were 73 gm. of olive, 86 gm. of cottonseed, 98 gm. of peanut, 64 gm. of coconut, and 90 gm. of sesame oils. Moreover, as much as 103, 125, 113, 131, and 106 gm. of these fats, respectively, were eaten by one of the subjects for a 3-day period without any physiological disturbance. In the first eight experiments with cocoa butter, in which an average of only 51 gm. of this fat was eaten daily, no abnormal conditions were noted and the apparent digestibility of fat was 90.7 per cent. In those experiments, however, in which from 82 to 138 gm. of cocoa butter were consumed daily and 86.5 per cent utilized, a decided laxative effect was noted. Accordingly it may be concluded that the limit of tolerance is less for cocoa butter than for the other fats studied.

"The evidence collected in these experiments affords additional proof that the digestibility of protein and carbohydrate contained in the different fat diets was not materially affected by the nature of the fat or by the amount eaten. . . .

"Judging from the results of the investigation as a whole, it is reasonable to conclude that olive, cottonseed, peanut, coconut, and sesame oils are very completely and readily available to the body and that they may, like the animal fats, be satisfactorily used for food purposes."

Studies on the digestibility of some animal fats, C. F. Langworthy and A. D. Holmes (*U. S. Dept. Agr. Bul. 507 (1917), pp. 20*).—This bulletin reports data regarding the digestibility of chicken, goose, beef-brisket, egg-yolk, and fish fats, as well as cream. The experiments are in continuation of earlier work (E. S. R., 34, p. 364). As in the above experiments, normal young men

served as subjects and the fats studied were incorporated in a basal ration. The results of the investigation are summarized in part as follows:

"The fats studied in this investigation were well digested, the coefficients of digestibility, with allowance for metabolic products and any undigested fat supplied by the basal ration, being, for chicken fat, 96.7 per cent; for goose fat, 95.2 per cent; for brisket fat, 97.4 per cent; for butter fat in the form of cream, 96.9 per cent; for the fat in egg yolk, 93.8 per cent; and for the fat in fish flesh, 95.2 per cent.

"On an average, 95 gm. of chicken fat, 95 gm. of goose fat, 80 gm. of brisket fat, 78 gm. of butter fat in the form of cream, 83 gm. of egg-yolk fat, and 60 gm. of fish fat were eaten per subject per day. In the case of goose fat, the feces were noticeably soft and occasionally a more decided laxative effect was noted, indicating that the limit of tolerance for this fat was not far about the 95 gm. which was eaten on an average. No physiological disturbance was noted with the other fats tested. Such matters have a practical value in discussing dietetics, aside from the theoretical question whether this laxative property is ascribable to differences in the chemical structure of the fats or to some other factor.

"The average coefficient of digestibility of brisket fat is higher than that previously found for beef (kidney) fat (93 per cent), which is in accordance with the observation that the digestibility is inversely proportional to the melting point. The other fats studied were either fluid or had a melting point not far from room temperature, so it was not surprising to find that they did not show marked variations in thoroughness of digestion."

The solidity of oysters, J. Nelson (*New Jersey Stas. Rpt. 1915, pp. 242–246*).—The solidity of oysters is defined as the proportion of the contents of an oyster shell that is nutrient, as distinct from the water present. This is discussed in connection with the practice of floating oysters before sale, especially with reference to the question of standards for determining the amount of such adulteration. It is stated that three distinct practices in connection with the swelling of oysters from the use of water fresher than that in which they are grown must be considered. These are, first, the practice of floating oysters in the shell; second, the practice of washing shucked oysters that are marketed as solid meat without liquor; and third, the practice of retailers to put the open oysters into a bucket of tap water, from which they are sold after standing for a varying length of time. The results are reported of analyses of several samples of oysters for solidity, and it is stated that each of the three cases mentioned above must be studied on its own merits, and that the problem of standards in any of these cases is much more complicated than in the case of milk adulteration.

The author states that there is need of further investigation of the rate and amount of swelling in each of these cases, and also of the injuries and benefits connected with various methods of handling oysters for sale. From the standpoint of health the real menace in the practice of floating oysters lies in the possibility of infection through the use of contaminated water.

Copper content of green oysters, J. Nelson (*New Jersey Stas. Rpt. 1915, pp. 242–249*).—This article contains a rather extended discussion of the copper content of oysters and the green color sometimes observed in these shellfish in certain localities. It is pointed out that various samples of shellfish, which are alike in showing the green color, are unlike in respect to the amount of copper present. The metal may be absent from the colored substance in some cases and some samples of uncolored shellfish may contain more of the metal than others which are colored. There is, therefore, no reason to believe that the green color is due to copper. It is further pointed out that copper is present

in the blood and tissues of shellfish, where it probably plays some part in respiration in the same way that iron does in the red-blooded animals.

Determinations were made of copper in several samples of oysters which showed marked blue coloration. Using the color test with potassium ferrocyanid, the three blue samples were found to contain about 40 mg. of copper apiece and the uncolored ones 9 mg. Using the more reliable method for determining copper by electrolysis, less than half of this amount of copper was obtained.

General statistics of the [Alaska] fisheries in 1915, W. T. Bower and H. D. Aller (*U. S. Dept. Com., Bur. Fisheries Doc. 834 (1917), pp. 28–68*).—A compilation of statistical data regarding the canning, curing, pickling, freezing, dry salting, drying, and smoking of salmon. Data are also included regarding the halibut, cod, herring, and whale fisheries, as well as the minor fisheries (trout, black cod, shellfish, etc.).

Some new constituents of milk.—II, The distribution of phosphatids in milk, T. B. Osborne and A. J. Wakeman (*Jour. Biol. Chem., 28 (1916), No. 1, pp. 1–9*).—The experiments here reported were carried out to extend earlier work (E. S. R., 33, p. 660). The following conclusions are drawn:

"Alcohol removes from milk casein, precipitated by dilute hydrochloric acid, about the same amount of phosphatids as was previously obtained from the 'lactalbumin' obtained by heating the filtrate from the casein. Since the amount of casein is more than six times as much as the 'lactalbumin,' the proportiton of phosphatid which it yields is correspondingly less.

"The precipitate produced by treating skimmed milk, freed from casein and heat-coagulable proteins, with sodium hydroxid until neutral to phenolphthalein contains a very small amount of the same phosphatids and fatty substances that can be obtained from the alcoholic washings of the heat-coagulable proteins ('lactalbumin'). The nonprotein fractions of fat-free milk contain at the most only minute traces of phosphatids. The total amount of phosphatids obtained from 1 liter of whole milk was equal to about 27 mg.

"Phosphatids are intimately associated with the protein constituents of milk and possibly are combined with them as 'lecithalbumins.'"

Milk: A cheap food, Flora Rose (*Cornell Reading Course for Farm Home, No. 3 (1917), pp. 73–85*).—This bulletin discusses the cost of milk as a source of body-building materials and body-regulating substances. It includes an outline for study clubs on the food value of milk and a bibliography of references on its nutritive value.

The colloidal swelling of wheat gluten in relation to milling and baking, F. W. Upson and J. W. Calvin (*Nebraska Sta. Research Bul. 8 (1916), pp. 27, figs. 5*).—The experiments reported in this bulletin deal with the changes in hydration capacity of gluten under different conditions, and consisted in determining accurately the amount of water absorbed by gluten from solutions of varying concentrations of different acids, both with and without the presence of salts. The results of the experiments may be summarized as follows:

"Wheat gluten is an emulsoid colloid and shows all the properties of this class of compounds.

"Gluten absorbs water from dilute acid solutions, thereby losing its tenacity and ductility, becoming soft and gelatinous. The presence of small amounts of neutral salts in the dilute acid solutions inhibits water absorption by gluten."

The bread-making qualities of dough made from wheat flour depend upon the quantity and quality of the gluten it contains. The quality of the gluten is regulated by the kind and concentration of the acids and salts present in the dough. "If the kind and amounts of the acids and salts are such as to

favor water absorption, the quality of the gluten will be poor, whereas the presence of acids and salts in such amounts as tend to inhibit water absorption makes for an improved gluten."

The experiments showed that carbon dioxid-free water is the ideal washing agent for use in making gluten determinations.

The following standard method for gluten determinations is proposed by the authors: "Weigh 10 gm. of flour into a round-bottomed cup. Work into a stiff dough with freshly boiled distilled water and allow to stand under water for one hour. Then work in a stream of the distilled water for 14 minutes over a bolting-cloth frame, to catch any pieces which may fall. Then work in the fingers for one minute and weigh on a tared dish. The weight of dry gluten may be obtained after drying at 110° C. to constant weight. As a check, nitrogen determinations may be made on the dry gluten."

Turnips, beets, and other succulent roots, and their use as food, C. F. LANGWORTHY (*U. S. Dept. Agr. Bul. 503 (1917), pp. 18, figs. 4*).—This bulletin, which is prepared especially for housekeepers, extension workers, and teachers and students of home economics, presents data regarding the food value of the succulent roots, beets, celeriac, carrots, parsnips, salsify, radishes, turnips, kohl-rabi, onions, garlic, etc., as well as of some of the less well-known root vegetables. There is also a discussion on the use of roots as condiments.

The nutritional value of the banana, V. C. MYERS and A. R. ROSE (*Jour. Amer. Med. Assoc., 68 (1917), No. 14, pp. 1022–1024*).—This article brings together and discusses experimental data regarding the ripening and chemical composition of bananas, and reports experimental data regarding the digestibility of the carbohydrates of bananas.

The utilization of the carbohydrates of the ripe, raw banana was found to be as good as that of the cooked foods employed in the control experiments. The ingestion of unripe bananas resulted in discomfort and discontinuance of the experiments at the end of the second day. When the bananas were not fully ripe there was considerable excretion of starch in the feces.

The authors pointed out that bananas "as sold in the market . . . are frequently not sufficiently ripe to be consumed to advantage immediately; and it would seem that gastro-intestinal disturbances when attributed to the banana were referable to this cause. . . . No ill effects, discomfort, or distaste were noted even after the consumption of large quantities of the ripe fruit for several days."

The experiments here reported showed that "much larger quantities of sugar (glucose, sucrose, levulose) may be given in the form of banana than as pure sugar (sucrose, glucose) without producing gastro-intestinal disturbances.

"The composition of the banana and the potato shows an interesting similarity both as regards total carbohydrate and the amounts of the different mineral constituents. While the banana can hardly be regarded as a potato substitute, the fact that it has practically the same caloric value as the potato is worthy of note.

"Of even greater importance is the fact that bananas may be eaten uncooked. This is of interest, in view of the increasing significance that is being attached to the thermolabile 'accessory food substances.'

"The banana would appear to be a particularly valuable food to employ in the dietetic treatment of nephritic patients with nitrogen retention. Very satisfactory results have been obtained in the rather mild cases of nephritis here reported."

[Germicidal effect of spices] (*Wisconsin Sta. Bul. 275 (1917), p. 46, fig. 1*).—Experiments at the station have shown that such spices as cinnamon, cloves, and

allspice have an inhibiting effect upon molds and bacteria, due to the essential oils which they contain. Molds were found to be more sensitive to these substances than were bacteria.

The nutritive value of agar agar and its use as a jellifying medium, C. R. Fellers (*Pure Products, 13 (1917), No. 4, pp. 177–185*).—Data are given regarding the sources, preparation, use, and composition of agar agar, together with a discussion of the character of the carbohydrates present in it and the utilization of agar agar as a food.

A study of American beers and ales, L. M. Tolman and J. G. Riley (*U. S. Dept. Agr. Bul. 493 (1917), pp. 23*).—A study of the composition of brewery products made in this country was carried out with the main object of finding, if possible, the means of distinguishing beers and ales made entirely from malt from those made from malt together with other products, such as rice, corn, and cerealin. The experiments were carried out under commercial conditions, with the cooperation of several breweries at which the samples of the product were taken at various stages of manufacture. From the analytical data which are reported in this bulletin the following conclusions are drawn:

"The all-malt beers made in this country contain higher percentages of protein than the all-malt beers made in Europe, owing to the use in this country of a barley high in protein.

"The use of rice, corn or corn products, and brewer's sugar as substitutes for malt reduces the content of protein, ash, and phosphoric acid in the finished beer. This difference, as regards the protein, ash, and phosphoric acid, is a sufficient basis for distinguishing the all-malt beers made in this country from those containing the commercial mixtures of rice, corn, cerealin, and brewer's sugar.

"It is necessary to calculate analytical results to the basis of a common wort in order to interpret them properly."

The vitamin content of brewers' yeast, A. Seidell (*Jour. Biol. Chem., 29 (1917), No. 2, pp. 145–154, figs. 4*).—Feeding experiments with laboratory animals (pigeons) were conducted to determine the quantity of autolyzed yeast filtrate which is necessary to balance the deficiency of an exclusive diet of polished rice and also to compare the activity of dried yeast with that of the autolyzed material. The results are summarized as follows:

"In the case of pigeons, the vitamin deficiency of an exclusive diet of polished rice is just replaced by daily doses of from 0.5 to 1 cc. of the clear filtrate from autolyzed brewers' yeast. Doses of dried freshly pressed yeast approximately equivalent to 1 cc. doses of autolyzed yeast do not effectively replace the vitamin deficiency of a diet of polished rice.

"Of two samples of dried yeast, one of which was autolyzed previous to being dried and the other not, the pigeons receiving the latter lost weight on a polished-rice diet considerably more promptly than those receiving the former. The autolytic process therefore appears to influence favorably the activity of the vitamin of brewers' yeast.

"On the assumption that all the nitrogen contained in fuller's earth which has been shaken with autolyzed yeast filtrate is derived from vitamin, the maximum quantity of the latter which can be present in the original yeast filtrate is 0.18 gm. per 100 cc.

"The daily vitamin requirement of a grown pigeon is somewhat less than 1 mg. A diet containing 0.0033 per cent of vitamin, given in quantities ordinarily consumed by pigeons, will supply this requirement."

[Food and drug inspection] (*Bien. Rpt. Dept. Agr. Fla., 14 (1915–16), pp. 213, pls. 10, figs. 4*).—This publication covers the work of the Division of Pure Food and Drugs, Stock Feed, Ferlitizers, and Citrus Fruits for the years 1915

and 1916. It contains the report of the district inspectors, the results of the testing of weights and measures, and extracts from laws, regulations, etc.

Cleaning silver by contact with aluminium in alkaline solution, H. L. LANG and C. F. WALTON, JR. (*Jour. Home Econ., 8 (1916), No. 8, pp. 418–421*).—A brief report of the experimental work, which has been noted in full from another source (E. S. R., 36, p. 266).

[Report on] nutrition, T. B. OSBORNE and L. B. MENDEL (*Carnegie Inst. Washington Year Book, 15 (1916), pp. 365–372*).—This is a progress report (E. S. R., 34, p. 762) of an investigation by the authors of the relative nutritional value of different vegetable proteins. This included studies of the value of the proteins of corn and cottonseed products and the food hormones of yeast, as well as further investigations of protein-free milk. The results of most of these experiments have been noted from the original sources.

Lectures on nutrition delivered under the auspices of the Washington Academy of Sciences, Washington, D. C., 1916 (*Washington, D. C.: Wash. Acad. Sci., 1916, pp. [78], fig. 1*).—This pamphlet contains reprints of the following five lectures, previously noted: The Biochemical Analysis of Nutrition, by C. L. Alsberg (E. S. R., 35, p. 368); The Basal Energy Requirement of Man, by E. F. DuBois (E. S. R., 35, p. 371); Food Economics, by G. Lusk (E. S. R., 35, p. 558); Studies on the Mineral Elements in Animal Nutrition, by E. B. Forbes (E. S. R., 35, p. 867); and The Importance of Vitamins in Relation to Nutrition in Health and Disease, by C. Voegtlin (E. S. R., 35, p. 861).

Studies in the physiology of the respiration.—I, The capacity of the air passages and the percentage of carbon dioxid in the alveolar air during rest and exercise, R. G. PEARCE (*Amer. Jour. Physiol., 43 (1917), No. 1, pp. 73–86, fig. 1*).—The author proposes methods for calculating the dead space and the percentage of carbon dioxid in the expired alveolar air, for which the necessary data are obtained by determining the amount of air and the percentage of carbon dioxid in the air of a normal and a deep expiration. Using these methods, only a small variation in the dead space or the percentage of carbon dioxid could be determined between the conditions of rest and exercise consisting of walking at the rate of 3½ miles per hour.

Review of recent literature on conditions of abnormal metabolism in infants, J. L. GAMBLE (*Amer. Jour. Diseases Children, 13 (1917), No. 4, pp. 362–389*).—A summary and digest of recent contributions to the literature of acute and chronic disturbances of nutrition, acidosis, rickets, scorbutus, etc.

ANIMAL PRODUCTION.

[Nutrition investigations at the Wisconsin Station] (*Wisconsin Sta. Bul. 275 (1917), pp. 8–12, 13–17, figs. 7*).—Notes on several studies are given.

Causes of bad effects of excessive wheat feeding, by E. B. Hart et al.—Earlier experiments (E. S. R., 33, p. 367) have shown that excessive feeding of wheat is decidedly injurious to cattle and swine. Further trials show that the effect of wheat feeding on the breeding capacity of cows is cumulative. No ill effect was apparent from such rations during the first gestation period, but when they were fed for two consecutive gestation periods or longer the offspring were born blind or weak. In other tests a ration containing a considerable amount of wheat embryo, but otherwise satisfactory, fed for only 60 days before parturition resulted in a characteristic weakness in the offspring.

Experiments with swine and rats indicated that the wheat embryo contains proteins of excellent character for growth, a large amount of the diet necessity water soluble B and a moderate amount of fat soluble A. Besides being deficient and unbalanced in mineral matter, however, wheat embryo contains a dis-

tinct toxic substance (the chemical nature of which is unknown) which may be largely extracted with ether along with the fat. When swine were fed a ration of wheat meal, wheat gluten, milk fat, and suitable salts they failed to grow after nine months and lost weight, finally showing difficulty in moving about, labored breathing, and muscular twitching. An examination of the spinal cord showed that the motor cells were shrunken, a condition similar to that produced in beri-beri.

Effect of restricted rations on poultry, by J. G. Halpin, E. B. Hart, and E. V. McCollum.—In experiments with poultry which have extended over a period of five years, it has been found that, while the death rate has been higher, fowls have made normal growth and produced fertile eggs on a wheat ration in most cases equally as well as on a corn ration. Young chicks fed cracked corn, green clover, and milk gained an average of 225.9 gm. in six weeks with no death loss; those fed wheat and green clover gained 58.8 gm., the death loss being 16 per cent; and those fed on corn and green clover gained 50.1 gm. with a higher death rate than those fed wheat and clover.

In a test of the effect of lime in the ration upon egg production, a scant supply of calcium has not caused the production of soft-shelled eggs, but has decreased the egg production. It is apparent that the hen draws upon her skeleton for the needed calcium when it is lacking in the ration.

Crushed v. whole oats for work horses, by F. B. Morrison, J. G. Fuller, and G. Bohstedt.—Tests for two winters with moderately worked horses showed no benefit from crushed oats during the first winter, but during the second winter the horses fed crushed oats and ear corn received 2 per cent less grain and gained 14.9 lbs. more per head in 18 weeks than those fed whole oats and ear corn. In a test with 18 hard-working horses during the spring and summer one horse in each team was fed whole oats and the other crushed oats, the horses fed crushed oats getting one-tenth less than the others. Both lots were fed the same amount of hay. At the end of 12 weeks the rations were reversed and continued for another 10 weeks. During the 24 weeks the horses fed crushed oats lost 38.5 lbs. each, and those fed whole oats lost 8.3 lbs. each, the results being similar during both periods.

Forage crops for pigs, by F. B. Morrison, J. G. Fuller, and G. Bohstedt.—In a test of forage crops *v.* dry lot for fattening pigs, rape pasture furnished excellent grazing throughout the experiment, July 20 to November 23. During this time the pigs on this forage gained 1.36 lbs. per head daily and required 3.77 lbs. shelled corn and 0.18 lb. tankage per pound of gain in addition to the rape. At 9.1 cts. per pound live weight for pork, 87 cts. per bushel for corn, and $50 per ton for tankage, these pigs returned $63.82 per acre of forage over the cost of concentrates. Another lot of the same number of pigs self-fed shelled corn and tankage on dry lot returned $14.58 over the cost of the concentrates.

[*Feeding experiments with lambs*], by G. C. Humphrey, F. Kleinheinz, and F. B. Morrison.—In a comparison of roots and corn silage for wintering ewe lambs, three trials of 105 days each were made during 1912 to 1915. Each winter one lot of lambs received 2 lbs. of ruta-bagas, 2 lbs. of hay, and 0.37 lb. of oats and bran (3:1) per head daily, and the other lot received 1.8 lbs. silage, 1.8 lbs. hay, and the same amount of concentrates as the first lot. Each year the silage-fed lambs made better gains, the average being 0.14 lb. per head daily, while those fed roots averaged 0.11 lb. daily. The silage-fed lambs were fully as thrifty as those fed roots, and sheared slightly heavier fleeces.

During one winter one lot of lambs was fed 0.5 lb. per head daily of a mixture of gluten feed and whole oats (1:1), and another lot an equal amount of a mixture of wheat bran and oats (1:1). In addition each lot received corn

silage and clover hay. The lambs relished the gluten feed and oats mixture and gained a trifle more than those fed wheat bran and oats.

In a comparison of cottonseed meal *v.* linseed meal for fattening western lambs, 40 lambs were fed for 70 days a ration of 0.21 lb. of linseed meal, 1.12 lbs. of shelled corn, 2.75 lbs. of silage, and 0.83 lb. of hay, and another lot of 40 lambs was fed 0.16 lb. of choice cottonseed meal, 1.16 lbs. shelled corn, 2.75 lbs. silage, and 0.85 lb. of hay per head daily. The lambs fed linseed meal gained 0.365 lb. per head daily at a feed cost of 8.62 cts. per pound of gain, and those fed cottonseed meal gained 0.37 lb. at a feed cost of 8.42 cts. per pound of gain.

Experiments with sheep, E. J. Riggs (*Ohio Sta. Bul. 303* (*1916*), *pp. 176, 177*).—At the Washington County experiment farm, a comparison was made during the winter of 1914–15 of linseed meal and cottonseed meal in equal quantities as supplemental feeds for breeding ewes. No great differences were found between the feeds. However, the lot on cottonseed meal maintained their weight better and sheared 0.5 lb. of wool per head more than those fed linseed meal. The ewes fed linseed meal produced lambs that were heavier at birth than those fed cottonseed meal. At ten days of age and at the close of the experiment the lambs from the cottonseed meal fed ewes were heavier than the others.

Forage crops [for hogs], F. C. Minkler (*New Jersey Stas. Rpt. 1915, pp. 67–73, pls. 2*).—Continuing experiments already noted (E. S. R., 34, p. 172) comparisons were made of different forage crops for swine.

It was found that where the animals were given their choice of forage crops brood sows nursing their young foraged quite as much on sweet clover as on alfalfa. Rape alone or rape and sweet clover were equally as palatable as alfalfa. Peas unaccompanied by oats or rape did not seem to attract the animals until they were more or less mature. It was noted that peas were more palatable when grown in the same area with oats and clover.

In case alfalfa is used as a forage with swine the area should be cut over at least twice during the season in order to increase its palatability and revitalize the plants. Light pasturage during the process of cutting alfalfa seemed to produce no injury to the stand.

Combination forage mixtures proved more useful and stable and produced more pork per unit of area than single forage crops. Pasturing forage crops early in the spring before the plants were 8 in. high proved to be an unsafe practice. It was found expedient to shut the animals out of the forage crop plats immediately following a heavy rain as a means of protection to the plants, and further to avoid injury from rooting by the animals. Where the combination mixture of oats, rape, peas, and clover was seeded and the areas not cropped close enough to prevent some of the oats from maturing a catch crop resulted and supplied palatable forage during the balance of the season.

A plat of 2.3 acres of rye, oats, Canada field peas, and sweet clover with grain supplement produced 781 lbs. of pork from May 11 to October 18 besides providing maintenance for 10 mature hogs from July 1 to October 18. A plat of 2.93 acres seeded to rye in the fall furnished green forage during the early spring for 18 gilts. On June 7 this plat was seeded to rape, soy beans, and sweet clover and provided maintenance for from 17 to 22 mature sows from August 12 to October 20, a small amount of green corn being fed as a supplement after October 1. An area of 4.76 acres of rye produced 1,270 lbs. of pork from April 20 to May 19, largely the result of young pigs running with their dams. This plat was then seeded to corn, and from the gleanings, after the corn was cut for silage with a corn harvesting machine, 30 shotes made a gain of 300 lbs. The yield of silage was about 11 tons per

acre. A plat of 0.26 acre of rape and sweet clover produced 215 lbs. of pork from nursing pigs from May 14 to October 12. Thirty head then grazed on this plat and fed 2,449.5 lbs. of a mixture of shelled corn, wheat middlings, and digester tankage in a self-feeder gained 772 lbs. A plat of 0.54 acre of rape, field peas, and sweet clover produced 1,050 lbs. of pork, furnishing green forage to 30 gilts during the whole summer. The gilts were also allowed 1 lb. of shelled corn per 100 lbs. live weight.

In all these experiments, unless otherwise stated, the animals were fed, in addition to the pasturage, 1 lb. of grain, chiefly corn middlings and tankage, per 100 lbs. live weight. Data on other grazing experiments are briefly reported.

[Problems relating to pork production] (*New Jersey Stas. Bul. 298 (1916), pp. 20–23*).—A mixture of rape and sweet clover in combination with oats as a protecting crop, with red clover added to secure permanence, had many advantages as a forage mixture for pigs. Rape alone was not very palatable. Soy beans with rape and sweet clover proved to be an excellent mixture, but furnished grazing for only a short time.

Experiments during the year indicated that pigs could be safely relied upon to select and balance their own rations. The use of the self-feeder shortened the growing and fattening period of pigs by at least 60 days. However, the use of the self-feeder in connection with grazing crops was not economical, especially for pigs under 100 lbs. in weight. It proved profitable for brood sows, nursing pigs, and fattening market hogs, but not for gilts intended for breeding or for market pigs during the entire cycle of their growing period. In wintering brood sows, it was found possible to maintain a 300-lb. sow on 3 lbs. of ground alfalfa hay per day, moistened with molasses and supplemented with a little hominy feed and tankage. The sows would eat only about 1 lb. of unground alfalfa hay per head daily.

Molasses was compared with corn and tankage as supplements for alfalfa hay for gilts. In this experiment five gilts fed molasses and alfalfa hay exclusively from the time they were weaned until after their first litter of pigs had been weaned, made their gains at slightly more than 3 cts. per pound less than those obtained with the five gilts fed corn, tankage, and alfalfa.

In spite of the fact that the entire station herd was subjected to the serum simultaneous treatment for the prevention of hog cholera, losses were frequent during the year and doubtful as to cause. That the double treatment under average conditions stunted the growth of pigs seemed well supported by conditions in the herd during the year. Losses were recorded among suckling pigs nursing immune sows although the sows were perfectly healthy.

The use of the self-feeder, F. C. MINKLER (*New Jersey Stas. Rpt. 1915, pp. 85–91, pls. 4*).—In the experiments here reported 50 shotes, 30 of which were pure-bred and 20 cross-bred, were fed for 77 days. Twenty of the animals were divided into four lots of 5 each and placed in dry lots 8 by 12 ft. with sleeping quarters in a protected building. Thirty head had the run of colony houses on a one-half acre plat of rape. Lot 1 in a dry lot and lot X (the 30 shotes in a rape field) were fed a mixture of shelled corn, wheat middlings, and digester tankage in self-feeders. Lot 2 was hand-fed the same mixture as a thick slop (100 : 38 : 12 by weight) in a dry lot. Lots 3 and 4 received shelled corn, molasses, and digester tankage, the former in the self-feeder and the latter by hand in the proportion of 100 : 40 : 15 by weight as a thick slop.

It was found that the pigs on the self-feeders consumed a surprisingly large amount of feed during the first few days of the test. All the animals went on full feed without difficulty or loss of appetite. The average daily gains per head were for lots 1 to 4 1.25, 0.73, 1, and 0.46 lbs., respectively, and for lot X

0.66 lb. The addition of molasses to a ration of corn and tankage did not reduce the cost or increase the efficiency of the mixture. Due in part to the interruption of hog cholera lot X did not make representative gains. The percentages of grain eaten by the self-feeder lots were as follows: Lot 1, corn 76, middlings 15, and tankage 9; lot 3, corn 82.6, tankage 13.5, and molasses 3.9; and lot X, corn 77.5, middlings 15, and tankage 7.5.

The advantages and disadvantages of self-feeders for hogs are discussed. They are recommended for use in feeding "brood sows nursing pigs, after the youngsters are 15 days old; pigs that have been weaned, provided they do not have access to a green forage crop; shotes that are being fattened either in dry lot, or forage crop, after they reach 100 lbs. live weight; and for fattening any animal in a dry lot where rapidity of gains is an advantage. The self-feeder should not be used for animals intended for breeding purposes as such animals will put on too much flesh and develop a tendency toward irregularity in their breeding propensities. Herd boars and sows that are being maintained preparatory for breeding should not have access to a self-feeder, for the practice will be expensive and a distinctive disadvantage unless the animals are out of condition and it is desired to put them in better flesh."

Swine husbandry, G. R. Eastwood (*Ohio Sta. Bul. 303 (1916), pp. 102, 103*).—In an experiment in hogging down rye at the Miami County experiment farm, 28 pigs, averaging 51.8 lbs., were grazed on two acres of a three-acre plat of rye for 38 days. In addition they were fed 0.25 lb. of tankage per head daily. They made a total gain of 459.5 lbs., or an average of 0.432 lb. per head daily, and consumed 5.71 lbs. of tankage per pound of gain. With pork at 8 cts., they made a net return of $15.10 per acre, with no charge for labor. The acre of rye not grazed yielded 13 bu.

Some of the results of hogging down three three-acre plats of corn in the fall of 1915 are given in the following table:

Results of tests of hogging down corn.

Plat.	Estimated yield per acre.	Number of pigs.	Average initial weight per head.	Period.	Tankage consumed per acre.	Average gain.		Net profit (pork 8 cts. per pound).
						Per head daily.	Per acre.	
	Bu.		*Lbs.*	*Days.*	*Lbs.*	*Lbs.*	*Lbs.*	
1	39.9	57	92	22	104.50	1.52	635.5	$48.23
2	49.7	62	121	18	92.91	1.57	584.5	44.44
3	48.8	60	153	18	90.00	1.66	596.8	45.49

Report of the department of poultry husbandry, H. R. Lewis and W. C. Thompson (*New Jersey Stas. Rpt. 1915, pp. 93–120, pls. 10*).—An experiment with White Leghorn pullets to determine the value of sour skim milk as a supplement to the regulation New Jersey ration for laying fowls has been previously noted from another source (E. S. R., 35, p. 479). It is stated that the results of the experiment indicate that "egg producers can afford to pay from 20 to 45 cts. per 100 lbs. for sour skim milk."

In an experiment upon the relative feeding value of certain common sources of high protein-carrying feeds from both animal and vegetable sources, a progress report of which has already been noted (E. R. S., 34, p. 176), the birds receiving protein from an animal source, meat scrap, produced in the two years of the experiment a total of 8,501 eggs as compared with 4,710 by the soy-bean meal pen, 4,003 by the gluten feed pen, 2,847 by the linseed meal pen, and 2,995 by the cottonseed meal pen. The meat scrap pen laid 5,596 eggs during the first

year of the test. From the standpoints of egg production, general health of the fowls, and economy the protein from the animal source was the most proficient. The flock receiving cottonseed meal and linseed meal apparently broke down during the second year, when the mortality was comparatively high. The ration containing the soy bean meal was the most expensive, meat scrap second, gluten feed third, linseed meal fourth, and cotton-seed meal fifth.

In the experiment comparing a 25 per cent and a 10 per cent meat scrap ration for laying hens the results secured during the third year confirmed earlier conclusions that high egg production during the pullet year is apt to be followed by decreased production in future years. The flock receiving the 25 per cent meat scrap ration laid 6,711 eggs the first year, 4,207 the second year, and 3,014 the third year, as compared with 4,639 during the first year, 4,358 the second year, and 2,674 the third year for the flock receiving the 10 per cent meat scrap ration. The total profit derived from the egg production of these two pens for the three years was $228.91 from the pen on 25 per cent meat scrap and $166.69 from the other pen. It is concluded that "under systems of management where birds are kept for two laying years only, a higher percentage of meat scrap can undoubtedly be advised, as the increased production during the first year will more than balance the difference during the second year. No general bad effects were noticed from the use of 25 per cent meat scrap in the dry mash."

In experiments being conducted for the purpose of ascertaining the factors causing the variation in shade of the shell color of eggs it has been found that some hens produce eggs varying widely in shell color and others show marked uniformity in the same respect.

A progress report is made of experiments with two forms of egg preservatives. In tests of the first form of preservative, the basis of which is sodium silicate, the eggs were put down on March 10, one jar in a normal 10 per cent liquid silicate solution, a second jar in a similar solution using another commercial brand of silicate, a third jar in a strong alkaline solution, a fourth jar in a commercial egg preserver (1 lb. to 2 lbs. of water), and a fifth jar in the same egg preserver (1 lb. to 16 lbs. of water). On examination the following September no perceptible loss of weight had occurred in any one of the samples. No difference could be detected in taste of boiled eggs from each sample nor any variation from the normal egg other than settling of the yolks in some of the jars. The eggs in the alkaline solution were the least satisfactory.

The second form of preservative was in the form of a commercial ointment. Several dozen eggs were anointed with this material, wrapped in papers, and stored according to directions of the manufacturer. After four months the eggs were in splendid condition. Both of these sets of jars and crates of preserved eggs are to be examined further.

In experiments with White Leghorns the following advantages of February hatching were indicated: The farmer can give his chicks better care, as this work will come before the rush of the spring season. Cockerels will sell at a higher price as broilers, for the height of the broiler market is early in the spring. Chicks will make a good growth before hot weather comes. Cockerels for breeders reach big, strong development early in the season. The pullets will produce a large number of eggs when the older hens are in the molt and the prices are high. The high production during August, September, and October more than counterbalances the falling off in egg production during November and December. The females reach full maturity long before winter sets in with its cold days, and pullets may be used the following year as breeders.

Influence of close inbreeding (*Wisconsin Sta. Bul. 275* (*1917*), *pp. 17, 18*).—Studies on the influence of close inbreeding of fowls (E. S. R., 35, p. 564)

indicate that under the unusually severe conditions of this experiment inbreeding has had distinctly detrimental effects. In 1913, 67 per cent of the fertile eggs from inbred stock hatched, while in 1916 only 18 per cent hatched. During this period the fertile eggs from check hens mated to inbred males decreased in hatching power from 67 to 64 per cent. Confirming previous results, the period of incubation was found to be lengthened in the case of the inbred flock.

There was a marked variation in the vitality of the inbred fowls, many of them being weak, while others made normal growth. In general the females were normal and the males frequently lacked vigor. It was also noted that a relatively larger number of inbred chicks failed to reach maturity.

The production of eggs for hatching, H. Atwood (*West Virginia Sta. Circ. 24 (1916), pp. 15*).—This is a brief review and list of experiment station and other literature bearing on the subject.

The incubation of hen eggs, H. Atwood (*West Virginia Sta. Circ. 25 (1917), pp. 24*).—This is a brief discussion of the general subject of incubation and a review of experiment station and other literature bearing thereon. The principles involved and the most improved methods in use at the present time are explained. A list of the literature cited is included.

Brooding and feeding little chicks, H. Atwood (*West Virginia Sta. Circ. 26 (1917), pp. 15, figs. 5*).—Full directions are briefly given.

Turkey raising, A. S. Weiant (*U. S. Dept. Agr., Farmers' Bul. 791 (1917), pp. 26, figs. 16*).—Full directions are given for raising turkeys, the points discussed being the turkey industry in the United States, profits from turkey raising, varieties, management of breeding stock, incubation, brooding, fattening for market, caponizing, marketing, and diseases.

Report of the department of biology, J. Nelson (*New Jersey Stas. Rpt. 1915, pp. 239–242, 251–260*).—Observations on the periods of spawning and spatting of oysters in relation to weather conditions are briefly reviewed. Data on spawning at Tuckerton and on oyster plankton and oyster spatting at Edge Cove during 1915 are tabulated.

Results of investigations during the year show that Canadian oyster larvæ at the time of spatting are a fourth larger than those of native New Jersey oysters. The soft parts of an oyster occupy only about half of the shell cavity. An abundance of snails was found to be associated with a scarcity of oyster fry. The most accurate method for determining the number of oyster fry in a plankton sample is that of sedimentation.

Oysters exposed at low tide are delayed in spawning, and for those always covered the spawning is dependent on temperature. The length of the free larval life of oyster fry at 77° F. is 16 days; at 80°, 13 days. The temporary raising of the temperature of water by warm waves causes the fry to rise to the surface, while cold weather drives them down. Larvæ reared by artificial fertilization reach the shell stage in their development only when the fertilization is made within ten minutes after the oysters are taken out of the water. At 90° the shell stage is reached within 12 hours after fertilization. Larvæ tend to stay near the bottom at night, while they rise when daylight appears. The adult oyster discriminates in its food, rejecting what is unsuitable. The larval oyster swallows everything small enough.

DAIRY FARMING—DAIRYING.

Report of the department of dairy husbandry, A. S. Cook (*New Jersey Stas. Rpt. 1915, pp. 125–141*).—Twelve cows in the early stages of lactation were divided into two lots of 6 cows each and fed for 100 days on the reversal

system to determine the value of cut alfalfa hay as a supplement for purchased grains. The lot fed the home-grown rations received alfalfa hay, silage, corn-and-cob meal, well cured alfalfa hay cut in a silage cutter, molasses, and soy bean meal. The other lot which was fed purchased rations received alfalfa hay, silage, corn meal, beet pulp, gluten feed, wheat bran, and cottonseed meal. The cows were so fed that each lot received about the same amount of dry matter and digestible nutrients. On the home-grown rations the cows produced 10,148.6 lbs. of milk and 350.6 lbs. of milk fat. Those on the purchased rations produced 10,125.7 lbs. of milk and 348.8 lbs. of milk fat. On the basis of market value the cost of the home-grown ration was $110.83, making the feed cost per quart of milk 2.3 cts.; and of the purchased feeds $120.17, or a feed cost per quart of milk of 2.5 cts. On the basis of cost of raising the feeds, the home-grown ration cost $73.51, a feed cost per quart of milk of 1.5 cts. When the cows were fed all the alfalfa hay they would eat and 35 lbs. of silage daily they consumed 4.14 lbs. of cut alfalfa daily with the grain mixture.

The average cost of feed per cow in the station dairy herd during the year was $100.97, as compared with $95.24 for the previous year. No pasturage was available for the cows during the year, and as a result about 60 per cent of the total cost of feed was spent for roughage. For the 37 cows in the herd during the year the average 12-months' record was 7,671.9 lbs. of milk and 295.17 lbs. of milk fat. With feeds charged at market prices the feed cost of producing milk during the year was $1.31 per 100 lbs. Charging roughage at cost of raising and concentrates at market value the feed cost of producing milk was 91 cts. per 100 lbs.

Data are given on the feed cost and gain in weight for heifer calves until freshening. Twenty Holstein heifers to an average age of 13¾ months had consumed feed valued at $46.94 each, and made an average daily gain of 1.64 lbs.; 7 Jersey heifers to an average age of 14¼ months had eaten $52.23 worth of feed each and gained 0.76 lb. each daily; 2 Guernsey heifers to an average age of 14¾ months had consumed $57.83 worth of feed each and made a daily gain of 0.96 lb.; 6 Ayrshire heifers to an average age of 17¾ months had consumed $65.81 worth of feed and made an average daily gain of 0.83 lb. per head; and a grade Shorthorn heifer had eaten $37.68 worth of feed by the time it was 13 months old and gained an average of 0.84 lb. daily.

Notes are also given on cow testing association and advanced registry work.

Efficiency of various protein concentrates for milk production, E. B. HART and G. C. HUMPHREY (*Wisconsin Sta. Bul. 275 (1917), pp. 7, 8, fig. 1*).—Continuing experiments previously reported (E. S. R., 35, p. 562), trials were conducted during the year to determine the efficiency of such protein-rich concentrates as gluten feed, dried distillers' grains, and linseed meal when fed with a basal ration of corn meal, corn stover, and corn silage. For comparison, casein and skim milk powder were also tested. Holstein cows producing from 40 to 45 lbs. of milk per head daily were used, being fed each concentrate for four weeks. The protein in the ration was kept below the amount needed to keep the cows from losing nitrogen from their bodies in order to bring out any differences in efficiency of the various concentrates. The nutritive ratio of the rations was fixed at 1:8, and the proteins from the concentrates tested formed one-half of the digestible protein in the ration.

When fed with the basal ration used in these experiments, gluten feed showed a considerably lower efficiency than linseed meal, distillers' grains, and either casein or skim milk powder. In spite of the constant loss of

nitrogen from their bodies the cows were able to sustain the milk flow at a high level. However, the milk solids declined from 12 per cent at the beginning to about 10 per cent at the end of the test.

Straw for growing dairy heifers, F. B. MORRISON, A. C. OOSTERHUIS, and G. BOHSTEDT (*Wisconsin Sta. Bul. 275 (1917), pp. 12, 13*).—In an experiment lasting 98 days with dairy heifers, 9 heifers fed a daily ration of 8 lbs. of alfalfa hay, 20 lbs. of corn silage, 1.75 lbs. corn meal, 0.5 lb. of wheat bran, and 0.25 lb. of gluten feed gained an average of 0.97 lb. per head daily. Another lot of 9 heifers fed 7 lbs. of oat straw, 26 lbs. of corn silage, 1 lb. of choice cottonseed meal, 1.5 lbs. of gluten feed, and 0.5 lb. of wheat bran gained 0.93 lb. per head daily and were judged as thrifty as the others at the end of the test. These heifers ate only 4.5 lbs. of oat straw per head daily, the remainder being used for bedding.

A study in the cost of producing milk on four dairy farms, located in Wisconsin, Michigan, Pennsylvania, and North Carolina, M. O. COOPER, C. M. BENNETT, and L. M. CHURCH (*U. S. Dept. Agr. Bul. 501 (1917), pp. 35, figs. 8*).—By means of carefully kept cost accounting records covering from four to seven years, data have been procured on the cost of producing milk on four dairy farms of the better sort located in Dane County, Wis., McComb County, Mich., Chester County, Pa., and Edgecombe County, N. C. This bulletin outlines the problem of obtaining the complete cost of producing milk on these farms and shows the relationship among the various items making up the total cost, as indicated by the data procured. The items of cost were classified as feed and bedding, labor, use of building, use of equipment, use of bull, interest, depreciation, miscellaneous items, and overhead. The actual and percentage costs of each of these items are tabulated.

It was found that the actual cost of keeping a cow for one year on the Wisconsin farm was $101.62, on the Michigan farm $125.45, on the Pennsylvania farm $103.12, and on the North Carolina farm $127.76. The most important cost item was the expense for feed, this constituting on the Wisconsin, North Carolina, and Pennsylvania farms, where the herds depended largely upon pasturage for summer feed, approximately 50 per cent of the total cost, and on the Michigan farm, where the cattle were stall-fed throughout the year, 57.2 per cent of the total cost. The cost of labor was next in importance to that of feed, averaging approximately one-fourth of the total cost. This labor includes the work of men and horses required to feed and care for the cows, handle the milk, and market the products.

The total credits other than dairy products, such as value of manure, calves, and, in some cases, an appreciation in the value of the cows, ranged from $12.27 to $20.33 per cow. The average annual production of milk and milk fat per cow for the years for which complete and comparable data were secured was for the Wisconsin farm 5,240 lbs. of milk and 256 lbs. of fat; for the Michigan farm, 6,536 lbs. of milk and 293 lbs. of fat; for the Pennsylvania farm, 5,053 lbs. of milk and 207 lbs. of fat; and for the North Carolina farm 5,142 lbs. of milk. The net cost of production per 100 lbs. of milk was as follows: Wisconsin farm, $1.52; Michigan farm, $1.61; Pennsylvania farm, $1.80; and North Carolina farm, $2.16. It cost 31.2 cts. per pound to produce milk fat on the Wisconsin farm, 35.9 cts. on the Michigan farm, and 49.8 cts. on the Pennsylvania farm.

The results obtained in this study, together with data from other sources, are discussed in their bearing upon the production of milk throughout the country. The relation of milk production and the cost per cow to the cost per

100 lbs. of milk, based on data from 443 complete records on the four farms studied, is shown in the following table:

Relation of amount of milk production and cost per cow to cost of milk production.

Annual production of milk per cow.	Number of cows.	Production.	Average per cow per year.			Average per 100 lbs. of milk.	
			Feed cost.	Other cost.	Total cost.	Feed cost.	Total cost.
Lbs.		*Lbs.*					
3,000 and under	16	2,349	$43.93	$39.97	$83.90	$1.87	$3.57
3,001 to 4,000	33	3,648	49.47	45.01	94.48	1.36	2.59
3,001 to 5,000	78	4,596	55.00	50.04	105.04	1.20	2.29
4,001 to 6,000	111	5,450	59.91	54.51	114.42	1.10	2.10
6,001 to 7,000	109	6,445	62.85	57.18	120.03	.93	1.86
7,001 to 8,000	60	7,514	70.38	64.04	134.42	.94	1.79
Over 8,000	36	9,049	80.45	73.20	153.65	.89	1.70

"Though it cost more to keep a cow that gives a high yield than one giving a low yield, the unit cost of the milk produced fell as the yield per cow rose. This decrease in the cost of milk per pound was much greater in the step from the poor cow to the cow of fair quality than in the step from the fairly efficient cow to the good cow or to the exceptional cow. Thus, from the standpoint of economic milk production, it appears that the first step in building up a poor dairy herd (that is, replacing scrubs with grades) is not merely the easiest step but also the one which promises the most for a given expenditure of money and labor."

Dairying industry of Ontario, G. R. Taggart (*U. S. Dept. Com., Com. Rpts., No. 25 (1917), pp. 394, 395*).—Statistics are given of the number of dairy cattle and the production, exportation, and prices of dairy products in Ontario in 1915 and 1916. A brief description of a patent cheese box designed to prevent breakage in the shipment of cheese is also given.

Third report of the commission on milk standards appointed by the New York Milk Committee (*Pub. Health Rpts.* [*U. S.*], *32 (1917), No. 7, pp. 271–296*).—This report deals briefly with the purposes and means of enforcement of milk standards and the grading of milk. Summaries covering a period of five years are given of the more important conclusions reached by the commission on chemical standards for milk bacteria and bacterial testing, pasteurization, grades of milk, cream, butter, ice cream, condensed milk, skim milk, and buttermilk, clarification, homogenization, licenses, and labeling. Appendixes give factors of primary importance in dairy practice for controlling the sanitary character of milk and a history of the commission.

Milk and cream regulations, I. C. Weld et al. (*Hoard's Dairyman, 53 (1917), No. 4, pp. 132, 160, 161, fig. 1*).—This report of the committee on milk and cream regulations, read before the Springfield, Mass., meeting of the Official Dairy Instructors' Association, gives the results of a study of the milk and cream regulations of 694 cities and towns in the United States. Complete regulations were obtained from 409 cities and towns and partially complete regulations from 62, while 223 cities, for the most part containing from 5,000 to 25,000 population and located in 45 States, reported that they had no regulations pertaining to the sale of milk and cream.

It is concluded that "there is a great and urgent need for further research and study on the part of our dairy investigators of some of the problems involved in the production and handling of milk, and . . . that definite in-

formation now available be placed in the hands of all who are responsible for the laws and ordinances governing the production, transportation, handling, and sale of milk."

The advantages of a carbohydrate medium in the routine bacterial examination of milk, J. M. SHERMAN (*Jour. Bact.*, *1* (*1916*), *No. 5*, *pp. 481–488*, *pls. 2*, *figs. 3*).—A study is reported of bacterial counts made on plain agar prepared according to the standard formula and on lactose agar with the same ingredients plus 1 per cent of lactose. Triplicate plates were made for each dilution and the counts were made after 48 hours' incubation at 37° C.

Results obtained from 18 samples of raw market milk showed an average increase of 43 per cent in the counts obtained with lactose agar over those obtained from plain agar. Fourteen of these samples showed an increase of over 20 per cent in favor of lactose agar. Data obtained from the examination of six samples of pasteurized milk showed increases of 141 to 1,050 per cent in favor of lactose agar. The average diameter of the ten largest colonies on plates from one culture of *Bacterium lactis acidi* was 64 μ on plain agar and 614 μ on lactose agar; for another culture of this organism 284 μ on plain agar and 833 μ on lactose; and for a streptococcus 228 μ on plain agar and 536 μ on lactose.

The carbohydrate medium was found to be of considerable value in differentiating the types of organisms on the plates.

A. T. C. classimeter, A. T. CHARRON (*Rpt. Min. Agr. Prov. Quebec*, *1916*, *pp. 91–94*, *figs. 4*).—A simple apparatus for the rapid classification of milk and cream on the basis of acid content is briefly described and directions are given for its use.

The effect of feeding on the composition of butter: Decorticated groundnut cake and decorticated cotton cake, H. T. CRANFIELD (*Analyst*, *41* (*1916*), *No. 488*, *pp. 336–339*).—Experiments carried out at the Midland Agricultural and Dairy College upon the effects on the composition of butter of feeding peanut cake and cottonseed cake are reported. Analyses are given of the two cakes.

Eight cows were fed for five weeks a basal ration of mangels, hay, bran, and dried yeast. In addition 4 of the cows were fed 4 lbs. of decorticated peanut cake and the others 4 lbs. of decorticated cottonseed cake per head daily. The fat of the butter made from the mixed milk from each set of cows, taken night and morning on alternate days, was subjected to analysis.

No great differences were found in the composition of the butter fat produced by the two groups except in the proportion of unsaturated fats, which appeared to be somewhat greater in the samples of butter produced from the peanut cake feeding. The butter from peanut cake feeding was much softer and usually rather darker in color than that from cottonseed cake. No special differences were noticeable in flavor of the two butters.

Why gelatin is required and its effect on quality [of ice cream], O. E. WILLIAMS (*Milk Dealer*, *6* (*1917*), *No. 5*, *pp. 18–21*).—Brief consideration is given to the use of gelatin in ice cream making, together with results of experiments conducted by the Dairy Division of the U. S. Department of Agriculture relative to the effect of gelatin on the quality of ice cream.

It was found that in some cases gelatin produced undesirable aftertastes. Some grades of gelatin seemed to accelerate and blend the cream and fruit flavor of the ice cream. Where too much gelatin was used the fruit flavor was not so pronounced. Gelatin that had been heated repeatedly produced ice cream having a weak body. The best results were secured when the gelatin was used the same day it was prepared and at a temperature of at least 160° F. before it was mixed with the cold cream.

Ice cream made from homogenized cream was packed in 3-gal. cans in an ordinary ice cream cabinet in a warm room. At the end of 48 hours the ice cream containing no gelatin had completely lost its identity and value as ice cream, while that containing a normal amount of gelatin was practically unchanged. Two cans of this ice cream were kept under favorable storage conditions for six months, at which time the flavor and texture of the gelatin was good and the more preferable of the two.

Correct payment for cheese factory milk by the Babcock test, J. L. Sammis (*Wisconsin Sta. Bul. 276 (1917), pp. 42, figs. 4*).—In this bulletin various methods for computing milk payments from the fat test at cheese factories are explained and illustrated by using each method for calculating payments for milk to a set of five factory patrons who deliver milk varying in fat content from 3 to 5 per cent. The payments are then compared with the values for the five lots of milk reckoned on the average yield of cheese of known moisture content, as determined by over 300 experiments and factory tests made by the New York State Station (E. S. R., 4, p. 948).

It was found in 94.97 per cent of 15,000 cases studied that the patrons' payments computed by the fat test were correct within 2 cts. on the dollar. In all cases a new method by which the weight of milk is multiplied by the percentage of fat plus 0.6 gave results within 2 per cent of the actual yield. Other methods were studied which also gave accurate results, but it is stated that the fat plus 0.6 method is the simplest and is therefore preferred for practical use. The pooling system is condemned.

Because of a belief that the percentage of casein in milk is not closely enough related to the percentage of fat to permit the use of a formula for calculating casein, the Hart casein test has been used at some factories in addition to the Babcock test as a basis of payment. Studies of over 2,200 payments to patrons of Wisconsin cheese factories showed that to a very considerable extent the variations in the results of using this test from month to month offset each other, so that the net gain at the end of the year was small in the great majority of cases. In view of the fact that the relative cheese-making value of different lots of milk depends upon the cheese-making solids which they contain, and is independent of the percentage of moisture in the cheese, the new method of computing payments is deemed equally applicable at Cheddar, Swiss, brick, and Limburger factories where whole milk cheese is manufactured and where the whey fat is recovered by skimming.

Comparison of the imported and domestic Swiss cheese, J. L. Sammis (*Wisconsin Sta. Bul. 275 (1917), p. 44*).—Results of analyses indicate that the average of 39 samples of imported Swiss cheese contained 49.8 per cent of fat, while the average of 48 samples of the domestic product was 52.04 per cent of fat. It is stated that the main difference between imported and domestic cheese seems to be due to the time and manner of curing. The imported product is held for six months or more before it is consumed, whereas the domestic cheese is usually sold or put into cold storage within a month or two from the time it is made. "Without long-continued curing and salting in a warm room, the quality of domestic Swiss cheese can not equal that of the imported product."

Effect of silage on quality of Swiss cheese, J. L. Sammis (*Wisconsin Sta. Bul. 275 (1917), p. 45*).—Results of experiments at the university creamery and of field studies indicate that, by proper cleanliness in feeding silage and handling the milk, it is possible to avoid cheese troubles due to the feeding of silage. An examination of the product of a number of factories producing block Swiss cheese from milk secured from silage-fed cows indicated that a good quality of cheese was generally secured. In some cases gassy fermentations affected

the quality of the milk, causing bloating of the cheese, but this was found to be due to the fact that infection came from the whey tank and was transmitted to the next day's milk through the use of the same cans for whey and milk.

Cheese making in Vermont, H. B. ELLENBERGER (*Bul. Vt. Dept. Agr., No. 25 (1916), pp. 31, figs. 3*).—In addition to statistical notes on the cheese industry in the State, suggestions are given for the manufacture of cheese under Vermont conditions. A floor plan for a cheese factory to handle up to 12,000 lbs. of milk is shown.

Skimming whey at Vermont cheese factories, H. B. ELLENBERGER and M. R. TOLSTRUP (*Bul. Vt. Dept. Agr., No. 26 (1916), pp. 10*).—Brief directions are given for the skimming of whey and the manufacture of whey butter at cheese factories. Results of three years' work at a small Vermont cheese factory show that 2½ lbs. of whey butter were made per 1,000 lbs. of milk, the net receipts to patrons being 4.6 cts. per 100 lbs. of milk.

The pasteurization of skim milk and whey as food for calves, V. A. MOORE (*N. Y. Dept. Agr. Bul. 81 (1916), pp. 1780–1797, pl. 1*).—This paper deals with the subject from the standpoints of the prevention of the spread of the germs of infectious diseases through milk and whey and the dietetics of heated milk. An appendix gives tabulated results of experiments by various workers on the thermal death point of tubercle bacilli. A bibliography is included.

VETERINARY MEDICINE.

Anaphylaxis to the separated proteins of horse serum, H. H. DALE and P. HARTLEY (*Biochem. Jour., 10 (1916), No. 3, pp. 408–433, figs. 10*).—From the study the authors conclude that each of the three proteins, euglobulin, pseudoglobulin, and albumin, separable from horse serum by their physical and chemical properties, can act as anaphylactic antigen. A guinea pig which has been sensitized by one of the proteins is more sensitive to that than to either of the others from the same serum. In some cases the sensitization appeared to be rigidly specific.

The sensitiveness of the guinea pig to albumin is developed later than is that to the globulins. This difference possibly accounts for the fact that previous investigators failed to detect the sensitizing property of albumin. The difference is especially marked when sensitization is carried out with the whole serum.

An effective dose of any of the proteins to which the guinea pig's plain muscles have been sensitized partially or completely desensitizes it to the other proteins of the same serum. No distinction of antigenic properties was shown by the crystalline albumins of the white of the eggs of hens and ducks.

The results are discussed in detail and are deemed of practical value in concentrating the curative element in a specific immune serum, where the ideal is "simply the reduction of the ratio of total protein to antitoxic value; for the purpose of reducing serum reactions the elimination of albumin seems to be as important as that of euglobulin, when the pseudoglobulin is the fraction carrying the therapeutic power." A relatively long latent period of the sensitiveness to albumin is considered to represent the successive appearance, at different time intervals, of sensitiveness to the different serum proteins rather than as representing separate reactions to the sera of the different animals which may have contributed to the serum.

The action of hypochlorites and allied substances on proteins, and their behavior on injection, T. H. MILROY (*Biochem. Jour., 10 (1916), No. 3, pp. 453–465, figs. 5*).—Experiments are reported in graphical form and discussed on the

action of hypochlorites on albuminous solutions, the action of chloramin-T on albumins, the action of hypochlorites and chloramin-T on amino acids, intravenous injections of hypochlorites and chloramin-T, and chloramin-T injections.

The effect of various chemical substances on the hemolytic reaction, N. P. SHERWOOD (*Jour. Infect. Diseases, 20 (1917), No. 2, pp. 185-200*).—Data obtained from the investigation of the effect of lactic acid, hydrochloric acid, sodium bicarbonate, and acetone on the complement content of rabbits in vivo; of ether and chloroform anesthesia on the hydrogen ion concentration and complement content of the blood of normal rabbits; and of the influence of carbon dioxid, lactic acid, hydrochloric acid, uric acid, urea, benzoic acid, tartaric acid, hydrazin sulphate, acetic acid, acetone, ether, and chloroform on the hemolytic reaction in vitro are reported in detail and discussed.

The data show an apparent drop in complement as a result of anesthesia. This, however, was found not to be constant. "The apparent drop probably is the result of the presence of the anesthetic, as well as of a slight increase in acidity. Sodium bicarbonate and lactic acid injected into rabbits did not cause a drop in complement; if anything, they caused an increase. The lactic acid was probably oxidized over into carbonates by the body, thereafter acting as an alkali." Hydrochloric acid injected into rabbits caused a marked drop in complement. This is considered to be due to the nonoxidizability of the mineral acids in the body. Acetone injected in fairly large amounts failed to cause a drop in complement.

Carbon dioxid, lactic acid, hydrochloric acid, urea, benzoic acid, tartaric acid, acetic acid, acetone, ether, chloroform, and hydrazin sulphate were found to deflect or destroy hemolytic complement in certain concentrations. All of these agents except urea and carbon dioxid caused a linking of human red blood cells in certain concentrations.

"In general it may be said that the zone of concentrations fixing complement very nearly approximates, and in many cases coincides with, the weakest dilutions producing hemolysis, and may extend down to include a few concentrations which are unable to produce hemolysis. The amount present in the blood is normally many times less than the amount required to affect complement. Under some pathologic conditions the concentration in the blood may be greatly increased, nearly approaching the amount which would affect complement."

It is indicated in the case of the anesthetics that there is "a twofold mechanism inhibiting hemolysis by amboceptor and complement—the action of the anesthetic on the permeability of the membrane, and the deflection of complement." The possibility that "some organic compounds might occasionally play some rôle in either inhibiting or intensifying the anaphylactic shock, since complement seems to be involved in this reaction," is suggested.

The passive transference of nonspecific antibodies, P. K. OLITSKY and B. S. DENZER (*Jour. Infect. Diseases, 20 (1917), No. 2, pp. 145-150, figs. 5*).—Experiments are reported in which one rabbit was repeatedly inoculated with increasing doses of dead typhoid bacilli grown on agar slant and another animal similarly inoculated with organisms of the same strain but grown on serum media. Care was taken to exclude particles of the media from the suspension used for inoculation. Ten days after the last injection blood was obtained from the animals and in the first case designated as "plain-agar typhoid immune serum" and in the second as "serum-agar typhoid immune serum." Guinea pigs were sensitized to these sera and later killed, and the uteri removed and tested in Locke's solution according to the procedure of Dale.

In the case of the guinea pig injected with plain typhoid immune serum the uteri had absorbed typhoid antibodies but there was no reaction to serum. In

the case of the guinea pig injected with serum typhoid immune serum the uteri had absorbed typhoid antibodies and at the same time antibodies against human serum.

The practical significance of the experiments reported is "that great care should be exercised in classifying bacteria by the ordinary method of testing against rabbit immune serum."

A comparative examination of the blood of certain Australian animals, G. BUCHANAN (*Proc. Roy. Soc. Victoria, n. ser., 28 (1916), No. 2, pp. 183–207, pls. 2*).—The author has examined the blood of various Australian batrachians, reptiles, birds, mammals, and one fish, and reports the results in tabular form, together with a brief discussion of the data.

In general a decrease in size and an increase in the number of the red cells was found in ascending through the various vertebrate groups. There was also a corresponding decrease in the number but an increase in the size of the lymphocytes. The mononuclears remained fairly constant in size but decreased in numbers. The polymorphs also increased in percentage counts with the rise in the scale of vertebrates. The eosinophils were really numerous only in birds and the higher reptiles, where there were also two kinds of granules, a round and a crystalloid variety, possibly pointing to an avian relationship. Mast cells were absent in the fish.

The occurrence in nature of certain yeast-like fungi with reference to their possible pathogenicity in the higher animals, W. H. EMIG (*Ann. Missouri Bot. Gard., 3 (1916), No. 2, pp. 243–307, figs. 13*).—From 850 different sources, 180 cultures of yeast-like fungi were obtained, but only 12 of these grew on a blood serum medium at 37° C. The 12 fungi included 6 cultures of Torula, 5 of Alternaria, and 1 of Oospora. One culture of Torula and 4 of Alternaria produced small quantities of alcohol in sugar nutrient solutions.

In acid yeast-water solutions all 12 of these organisms brought about a change in the acidity reaction, there being a decrease in the acidity of all the acid nutrient solutions except in the presence of acetic acid and in one culture.

"The results of 34 animal experiments were negative in that the death of certain animals was not caused by the formation of lesions or abnormalities due to the organisms injected. No extracellular toxins were obtained from the cultures of these 12 yeast-like organisms.

"The results of these experiments and a review of literature on animal pathology indicate either that pathogenic yeast-like fungi do not occur in nature, or that, if they are present, they are so few as to be met with only under exceptional conditions."

Reports of the civil veterinary department, Assam, for the years 1914–15 and 1915–16, W. HARRIS (*Rpt. Civ. Vet. Dept. Assam, 1914–15, pp. 28; 1915–16, pp. 29*).—The usual annual reports (E. S. R., 32, p. 81).

Annual reports of the civil veterinary department, Bihar and Orissa, for the years 1914–15 and 1915–16, D. QUINLAN (*Ann. Rpt. Civ. Vet. Dept. Bihar and Orissa, 1914–15, pp. 15+XIV+2; 1915–16, pp. 15+XVI+2*).—The usual annual reports (E. S. R., 32, p. 272).

Report on the civil veterinary department (including the Insein Veterinary School), Burma, for the year ending March 31, 1916, G. H. EVANS (*Ann. Rpt. Civ. Vet. Dept. Burma, 1916, pp. 7+15, pl. 1*).—The usual annual report (E. S. R., 34, p. 275).

Regulations adopted by the Live Stock Sanitary Board and the live stock sanitary law of Alabama, 1916 (*Auburn, Ala.: State, pp. 28*).—The text is given.

Notes on fowl pest (pestis avium) and foot-and-mouth disease, S. BELFANTI and A. ASCOLI (*Clin. Vet. [Milan], Rass. Pol. Sanit. e Ig., 39 (1916), No. 19, pp.

577–597, pl. 1).—Detailed tabular experimental data of a number of inoculation experiments with the virus of fowl pest in varying dilutions are submitted. The defibrinated blood of a fowl which had died from the disease was found to cause marked temperature rises but not to confer immunity.

Data obtained from immunization experiments against foot-and-mouth disease are also reported. The bovine virus was found to cause febrile manifestations and stomatic lesions in swine in two days. The material obtained from the stomatic vesicle mixed with blood and kept in a thermostat for five days did not cause any stomatic manifestations, and conferred immunity only in the presence of bovine or porcine virus. The results reported are considered to be merely preliminary, and no definite conclusions are drawn.

Comparative study of Bacillus anthracis-symptomatici and allied organisms with respect to gas production, L. C. Todd (*Jour. Infect. Diseases, 20 (1917), No. 2, pp. 151–169*).—Detailed tabulated experimental data obtained from a comparison of results in gas production from sugars by *B. anthracis-symptomatici* and allied organisms show that the organism produces more gas from dextrose, levulose, and maltose than *B. œdematis-maligni*. The greater proportion of this gas is carbon dioxid. The training of seed cultures was found to influence the gas production of these organisms considerably.

"Substances credited with the putrid odor are produced in cultures by strain members of both groups. The gas production of most of the strains occurs late and progressively up to about the tenth day. In some media gas production continues to a slight degree for some time after this. An explosive mixture of gases, apparently containing hydrogen and no carbon dioxid, may be produced from 'carbohydrate-free' broth."

The conglutination reaction in the diagnosis of glanders compared to other diagnostic methods, G. B. Scotti (*Mod. Zooiatro, Parte Sci., 27 (1916), Nos. 9, pp. 213–224; 10, pp. 246–256*).—The author concludes that the conglutination test is the most desirable for the diagnosis of glanders. The results are in accordance with those obtained by complement deviation but the conglutination procedure is preferred.

The precipitin reaction is considered to present certain possible sources of error which depend largely on the technique. The intrapalpebral reaction is deemed a very accurate diagnostic procedure.

The ophthalmic reaction was found not always to yield reliable results. Its positive reactions are of value, but the negative ones do not necessarily exclude infection. Repeated instillations of mallein can not always be relied upon to reveal infection. On account of the ease of recognizing positive results the reaction is considered of value as a subsidiary test.

Piroplasmosis and other parasite diseases of the blood of domestic animals in the Balkans, W. N. Markoff (*Arch. Schiffs u. Tropen Hyg., 20 (1916), No. 14, pp. 313–335; abs. in Trop. Vet. Bul., 4 (1916), No. 4, pp. 151–154*).—This report of observations made for the most part during 1912 to 1914 at various places in the Balkans relates particularly to protozoan diseases.

The reliability of cell proliferative changes in the diagnosis of rabies, J. B. Hardenbergh and B. M. Underhill (*Penn. Live Stock Sanit. Bd. Circ. 46 (1916), pp. 10, figs. 6*).—Previously noted from another source (E. S. R., 36, p. 80).

Rabies eradication in Nevada, S. E. Piper and E. R. Sans (*Carson City: Nevada Rabies Com., 1916, pp. 7, figs. 2*).—This is a report upon the progress of the rabies eradication campaign carried on under the direction of the Bureau of Biological Survey of the U. S. Department of Agriculture in cooperation with the Nevada Rabies Commission.

Draft of proposed law for immunization of cattle and carabao in the Philippine Islands and correspondence relative to such immunization, H. S. Martin (*Manila, P. I.: Dept. Pub. Instr., 1915, pp. 29*).—This is a detailed draft of the proposed law in both English and Spanish.

A further report of the diagnosis of open cases of tuberculosis, D. H. Udall and R. R. Birch (*Cornell Vet., 7 (1917), No. 1, pp. 13–29*).—The results of a study carried out to demonstrate the possibility of recognizing open cases, or "spreaders," of the disease, covering a period of about six years, are reported in detail and discussed.

Reliance upon a physical examination alone for the suppression of the disease is considered to be a failure from the results obtained. It is, however, of value in the partial reduction of the number of "spreaders" in a badly infected herd. It is also considered to be of service in detecting the occasional nonreacting "spreader."

A uniform standardized system of inspection is recommended.

Tuberculosis of fowls (*Wisconsin Sta. Bul. 275 (1917), pp. 40, 41*).—Experiments on the communicability of avian tuberculosis to swine by inoculation of pure cultures of the avian organism, by B. A. Beach, E. G. Hastings, and J. G. Halpin, are noted. Fatal results were obtained in every case, although it is considered that the post-mortem examination would have hardly indicated that the changes were due to the tubercle bacillus. "While these cases of fatal tuberculosis were produced in hogs by artificial inoculation, it is doubtful whether the avian tubercle is able to produce a fatal termination of the disease when the infection is acquired under natural conditions, as by feeding."

The "wattle" test with avian tuberculin was found to be highly satisfactory.

Special report on diseases of cattle (*U. S. Dept. Agr., Bur. Anim. Indus., 1916, rev. ed., pp. 568, pls. 50, figs. 29*).—A revised edition of the work previously noted (E. S. R., 21, p. 283).

Some facts about abortion disease, E. C. Schroeder and W. E. Cotton (*Jour. Amer. Vet. Med. Assoc., 50 (1916), No. 3, pp. 321–330*).—A paper, presented at the meeting of the Massachusetts Veterinary Medical Association, at Springfield, Mass., in October, 1916, in which the authors discuss some of the results of their recent work.

Since the *Bacillus abortus* is an obligatory parasite, its chronic persistence in the bodies of infected cows is probably the most important among the causes responsible for the propagation, perpetuation, and wide prevalence of the disease. In numerous tests made with milk from many different cows the abortion bacillus was never found in the milk of a cow unless both her milk and her blood serum possessed agglutinating properties for suspensions of abortion bacilli. This, however, does not necessarily mean that the milk of all cows which react with the agglutination test for abortion disease is infected, since tests of milk from reacting cows have been made without detecting abortion bacilli.

Investigations thus far indicate that the blood serum of reacting cows with uninfected udders gradually loses its power to agglutinate suspensions of abortion bacilli. If this proves to be the case, it is held that with other facts it will justify the conclusion that the persistence of agglutinating and complement-fixing substances in the blood of cows, relative to abortion disease, is intimately associated with the abortion bacilli that enter that body through the lymphatics from infected udders. That abortion bacilli do not maintain themselves in the bodies of cows elsewhere than their udders and gravid uteruses is a contention for which they have obtained fairly convincing proof. The authors consider the evidence at hand sufficient to prove that abortion bacilli do not main-

tain themselves in the bodies of nonpregnant cows elsewhere than in their udders.

Investigations of seemingly vigorous, healthy calves produced by cows with infected udders have shown that such calves may harbor abortion bacilli in their stomachs and gastro-hepatic lymph glands, but invariably when the calves were infected the afterbirth and the uteruses of their dams were also infected with the disease.

The authors find that the agglutination test for abortion disease is fully as reliable as the complement-fixation test, but far less complex, and hence, in the hands of those who have many and varied duties, more reliable. The introduction of abortion bacilli into the udder through the teat, though a method of injection was used which almost certainly precluded mechanical injury, positively infected it and caused the gradual development of agglutinating power for suspensions of abortion bacilli in the blood serum. The passage of abortion bacilli from the udder to the uterus is held to be an experimentally demonstrated fact.

The present status of the abortion question, A. Eichhorn and G. M. Potter (*Jour. Amer. Vet. Med. Assoc., 50 (1916), No. 3, pp. 295–320*).—The data given in this paper, presented at the meeting of the American Veterinary Medical Association, at Detroit, Mich., August 22, 1916, are based upon investigations carried on by the U. S. Department of Agriculture.

In discussing the difficulties met with in their investigations of contagious abortion of cattle, reference is made to the new type of the organism which occurs in the milk of certain cows, recently described by Alice Evans (E. S. R., 35, p. 675), and to which the name *Bacillus abortus lipolyticus* is given because it decomposes butter fat. This type has failed to react to the agglutination and complement-fixation tests and feeding and inoculation tests have also been inconclusive. A strain of *B. abortus* from pathogenic sources after having grown for 9.5 months in a medium containing milk fat acquired the same fat-splitting property.

In several herds where abortions have occurred occasionally repeated serological tests have failed to demonstrate the presence of *B. abortus*. Whether these organisms play a causative rôle in such cases; whether they are attenuated forms of the pathogenic variety which have lost some of their characteristics as they acquired the fat-splitting property, and if so, whether under certain circumstances they may not regain their pathogenic properties; and whether they are detrimental to human health are questions that remain to be determined.

The authors' experience leads them to believe that there may be some organism of which nothing is known at the present time that may eventually be found to cause abortion in at least part of those cases (some 5 per cent) now recognized as nonspecific abortion.

In a discussion of immunity the authors state that even among young cows abortion occurs but once in much more than 50 per cent of the cases. Whether this be called immunity or by some other name there is unquestionably some protective agency that for all practical purposes must be recognized as an acquired resistance against the disease. In a large herd at Washington, D. C., where investigations have been carried on, abortions were frequent while new cows were being purchased and susceptible material thus added, but as the practice was discontinued and the calves born in the herd were raised the disease progressively decreased, until at the present time abortion is rare and a definite herd immunity seems to have been established.

The authors find that serological tests are not infallible, due to the fact that both the infected animals and the immune ones which no longer harbor the

causative organism in their bodies may react. It is also pointed out that a reaction does not necessarily indicate that the animal has aborted or that it will abort, since the immunity may have been acquired without the occurrence of any visible manifestations. Also an aborting cow may sometimes fail to react.

In discussing the time and method of infection the authors report upon agglutination tests made of the blood of the female cattle of breeding age in a herd consisting of more than 2,000 head of Jerseys, of which about one-third were pure-breds and the remainder grades. Of the 413 cows which had produced calves 159, or 38.5 per cent, aborted and of these 120 aborted once, 35 twice, and 4 three times. Fifty-eight of the cows which aborted once gave a positive reaction and 8 were questionable, and of these 66, 9 showed difficulty in breeding. Fifty-four aborters gave negative reactions and 3 showed difficulty in breeding. Of the 35 which aborted twice, 27 were positive and 3 questionable, and of these 2 showed difficulty in breeding; 5 gave negative results and showed no difficulty in breeding. Of the 4 cows which aborted three times, 3 reacted positively and 1 negatively, but no difficulty in breeding was recorded. Twenty-five cows showed difficulty in breeding without aborting, and of this number 10 gave positive reactions, 12 negative, and 3 questionable. Sixty-six reacted positively without showing other evidence of infection. The facts presented seem to contradict strongly the contention that infection is to a considerable degree acquired during calfhood.

With a view to determining the degree to which calves and bulls are infected, numerous samples of blood were collected at the abattoirs of Baltimore, Philadelphia, Washington, and Richmond from animals of dairy breeding. There were tested 182 bulls over one year of age, of which 10 were positive and 6 were questionable. Of 520 male calves up to one year of age 7 gave positive and 4 gave questionable reactions, and of 299 female calves of like age 2 positive and 2 questionable reactions were obtained.

The authors' conclusion in regard to immunization is that at present such treatment should be regarded as second in importance to proper sanitation. In referring to medicinal preparations, including proprietary remedies, it is pointed out that there is no supporting evidence available for any of such preparations. Inasmuch as there is no therapeutic treatment known at present which will either prevent or cure infectious abortion, attention should be primarily directed toward prevention by sanitation. Suggestions are given as to the control of abortion, together with a discussion of methods of disinfection.

Contagious abortion of cattle, A. Eichhorn and G. M. Potter (*U. S. Dept. Agr., Farmers' Bul. 790* (*1917*), *pp. 12*).—A general account of the disease and its treatment. It is pointed out that while formerly confined almost entirely to dairy cows it has now spread to the beef herds on the range, where the losses are proving especially severe. The stockmen, as well as the dairymen, are urged to awake to the seriousness of the situation and combine for a systematic campaign against the disease.

Practically significant facts about abortion disease, E. C. Schroeder and W. E. Cotton (*Amer. Jour. Vet. Med.*, *12* (*1917*), *No. 2*, *pp. 73–78*).—A paper presented at the meeting of the U. S. Live Stock Sanitary Association held at Chicago in December, 1916, in which the authors present the practical results of investigations substantially as noted above.

Possibilities and limitations in control of abortion, C. J. Marshall (*Amer. Jour. Vet. Med.*, *12* (*1917*), *No. 3*, *pp. 157*, *158*).—A paper presented at the meeting of the U. S. Live Stock Sanitary Association at Chicago in December, 1916.

Investigations into the occurrence of onchocerciasis in cattle and associated animals in countries other than Australia, Georgina Sweet (*Proc.

Roy. Soc. Victoria, n. ser., 28 (1915), No. 1, pp. 1–51, pls. 5).—Previously noted from another source (E. S. R., 34, p. 582).

Serum studies on hog cholera (*Wisconsin Sta. Bul. 275 (1917), p. 41*).—The use of sodium iodoxybenzoate to increase the production of antibodies in immune sera, as reported by earlier investigators, was tested in the production of hog-cholera serum. While the serum of hyperimmunized animals so treated showed a slight increase in potency, the increase was not deemed "sufficient to justify the use of this agent in commercial manufacture."

[Hog cholera inoculations with serum globulin], F. C. MINKLER (*New Jersey Stas. Rpt. 1915, pp. 76–85*).—The results of the treatment of 201 animals (ranging in age from suckling to mature breeding animals five years of age) by the serum alone treatment with serum globulin are reported. Each animal was inoculated with 30 cc. of the globulin. Thirty-eight animals of the total number died, 31 of which had a temperature above 105° F. at the time of injection. All of the control animals not inoculated with serum, with the exception of two, died subsequently to being turned out to produce contact exposure with well animals.

Three cases of abortion followed the injection, one of which was undoubtedly due to injury received at the time of injection. Serum when injected into pigs whose temperature was normal at the time of inoculation protected in all cases. It is, however, considered not to have established any curative properties of economic worth.

Special report on diseases of the horse (*U. S. Dept. Agr., Bur. Anim. Indus., 1916, rev. ed., pp. 629, pls. 42, figs. 18*).—A revised edition of the work previously noted (E. S. R., 15, p. 619).

[Poultry disease observations], H. R. LEWIS and W. C. THOMPSON (*New Jersey Stas. Rpt. 1915, pp. 120–122*).—Investigations made of the occurrence during the hot summer months of what was termed "summer poisoning" led to the conclusion that this trouble was a form of ptomaine poisoning resulting from the fowls eating decayed flesh of carcasses of other fowls. The only treatment found practical in such cases was the administration of a dose of Epsom salts, one-half teaspoonful dissolved in a little warm water and poured down the throat of each fowl.

Campaign to eliminate bacillary white diarrhea (*Massachusetts Sta. Circ. 65 (1916), folio*).—A revision of Circular 56, previously noted (E. S. R., 34, p. 189).

An intradermal test for Bacterium pullorum infection in fowls, A. R. WARD and B. A. GALLAGHER (*U. S. Dept. Agr. Bul. 517 (1917), pp. 15*).—In searching for an accurate method of detecting the presence of the causative organism of bacillary white diarrhea in fowls that is simpler and cheaper than the agglutination test, the authors have found the intradermal test to give encouraging results.

In their experiments a killed culture of *B. pullorum* grown for about a month and held for several weeks before use and without further treatment than carbolizing has given the most satisfactory results. The edematous swelling resulting from the injection of this product into the wattle of a fowl, when observed at the proper time interval, is an indication of the presence of infection of *B. pullorum* in the fowl. Readings made at various time intervals have led to the conclusion that the 24-hour interval gives the most accurate results.

"The weight of evidence indicates that any perceptible swelling of the wattle should be regarded as significant. A second intradermal test made at an interval of four days gave results varying but little from the first test. Others made at intervals up to two months gave less accurate results the second time. Thus, there is no advantage in retesting.

"Of birds artificially infected with the disease and tested in the laboratory, in round numbers 90 per cent gave positive reactions; and in 6 per cent the test failed to indicate a reaction when lesions were present. In 3 per cent no reaction occurred and no lesions were present. In a field test on 231 birds made simultaneously with the agglutination test, the intradermal test at 38 hours failed to detect one case reported positive to the other test. In a second flock of 50 birds in which the two tests were compared, the intradermal test when read at 46 hours failed to indicate one case that was detected by the agglutination test. Another group of about 100 birds tested under unfavorable conditions gave less satisfactory results. . . . Autopsy does not furnish an absolute standard for comparing the accuracy of tests. Seventy-two per cent only of naturally infected birds that had reacted to one or both tests were found on autopsy to be unmistakably infected. . . .

"The intradermal test has already shown sufficient promise to warrant further extensive trials in the field in comparison with the agglutination test."

Poultry farm disinfection, J. B. PAIGE (*Massachusetts Sta. Circ. 66 (1916), pp. 4*).—This circular describes briefly some simple methods of disinfection applicable to the poultry farm.

American records of Dioctophyme renale, M. C. HALL (*Jour. Amer. Vet. Med. Assoc., 50 (1916), No. 3, pp. 370, 371*).—The author calls attention to two records of the occurrence of the giant kidney worm additional to those compiled by Riley (E. S. R., 36, p. 86).

RURAL ENGINEERING.

Thirteenth biennial report of the state engineer of Wyoming, 1915–16, J. B. TRUE (*Bien. Rpt. State Engin. Wyo., 13 (1915–16), pp. 379, pls. 11*).—A report for the years 1915 and 1916.

Second report on the water powers of Alabama, B. M. HALL and M. R. HALL (*Geol. Survey Ala. Bul. 17 (1916), pp. 448, pls. 19, figs. 4*).—This report gives the results of measurements of flow made on the important streams of Alabama.

Surface water supply of the lower Mississippi River basin, 1915 (*U. S. Geol. Survey, Water-Supply Paper 407 (1917), pp. 5–43+XXXIII, pls. 2*).—This report, prepared in cooperation with the States of Colorado and New Mexico, presents the results of measurements of flow made on the Arkansas and Red River basins during 1915. A section on stream-gaging stations and publications relating to water resources is appended.

Ground water for irrigation in the Morgan Hill area, California, W. O. CLARK (*U. S. Geol. Survey, Water-Supply Paper 400–E (1917), pp. 61–108, pls. 3, figs. 5*).—This report deals with the geology and ground water of an area of about 15,730 acres in the Santa Clara Valley, Cal. Precipitation and stream flow data affecting the area are also included.

"The soils of the region range from gravelly clay loam to a rather heavy sandy loam and vary widely in fertility. In the central part of the area, about Morgan Hill, they consist predominantly of coarse, angular gravel and on the whole are the least fertile in the area, though even in this locality they show rather wide variations in character and fertility, some of them being very open and porous and others comparatively tight and impervious."

"In the Morgan Hill area the ground water occurs in the valley alluvium. Over most of the valley area the water table . . . lies at a depth of about 20 to 80 ft. below the surface of the ground during the low-water season and about 15 to 50 ft. during the high-water season. . . . Although the development of the ground water within the proposed irrigation district has been very slight, so far as it goes it seems to show satisfactory results, and apparently wells in this

area might be expected to yield enough water for irrigation. . . . It appears probable that as much as . . . approximately 1 acre-foot per acre will be annually available for irrigation within the district."

Pumping tests on three wells in the area and tables of logs of wells in the area are included.

Critical judgment and use of the waters of the pampas, F. A. Mazza (*An. Soc. Cient. Argentina, 81 (1916), Nos. 1–2, pp. 71–128, pls. 8, figs. 6; 3–4, pp. 129–213, fig. 1*).—This report deals in general with the geology and soils of the pampas and the relation of soil and water, gives chemical analyses of both soils and waters, and discusses the waters with reference to their use for domestic purposes and irrigation and in the industries.

The waters are divided into two types, those low in mineral content and those highly mineralized. In general they are more alkaline than hard, but in the highly mineralized waters the hardness is greater than the alkalinity. The waters of low mineral content are said to contain very little sulphates and chlorids, but are relatively rich in bicarbonates, while the highly mineralized waters contain an abundance of chlorids and sulphates. The waters of low mineral content are considered suitable for drinking, irrigation, and boiler use, while the highly mineralized waters are said to be not fit for such uses.

The divining rod: A history of water witching, A. J. Ellis (*U. S. Geol. Survey, Water-Supply Paper 416 (1917), pp. 59, figs. 4*).—This is an outline of the history of the use of the divining rod for locating underground water supplies and of so-called water witching, and includes an introductory note by O. E. Meinzer and an extensive bibliography of works bearing on the subject.

"The outline of the history of the subject presented will probably enable most honest inquirers to appreciate the practical uselessness of 'water witching' and other applications of the divining rod. . . . It is difficult to see how for practical purposes the entire matter could be more thoroughly discredited."

The advice is given to all inquirers "not to expend any money for the services of any 'water witch' or for the use or purchase of any machine or instrument devised for locating underground water or other minerals."

Irrigation module investigations, 1913 (*Glav. Uprav. Zemleustr. i Zemled., Gidrom. Chast* [*Pub.*], *1914, Nos. 1, pp. XII+387+49, pls. 17, figs. 18; 2, pp. XIX+391+344, pls. 79, figs. 44; 3, pp. VII+460+II, pls. 19, figs. 30; 4, pp.* [*III*]*+49; 1915, No. 5, pp.* [*III*]*+39, pls. 11*).—This report is in four volumes and deals with duty of water investigations in Turkestan in 1913.

The soils of the regions studied consist mainly of fine-grained loess, sand, coarse dust, dust, silt, and fine particles. Experiments with alfalfa, cotton, winter wheat, and corn showed that for alfalfa the module is 0.36 second-liters per dessyatina (0.035 second-gallons per acre) for cotton 0.31 second-liters, for wheat 0.25 second-liters, and for corn 0.38 second-liters. Experiments on flooding and furrow irrigation are also reported.

It was found that a single irrigation of more than 128 cubic sagenes per dessyatina (a depth of about 4.5 in.) checks the growth of cotton temporarily. An irrigation of 910 cubic sagenes for the season giving not more than 227 cubic sagenes at each irrigation increased the height of cotton but delayed its ripening. The irrigation of cotton during blooming delayed its ripening at the rate of three days per each 100 cubic sagenes. The most profitable application of water to cotton proved to be 384 cubic sagenes per dessyatina per season, divided into three to four irrigations.

A better yield of cotton was obtained with check irrigation than with flood irrigation of cotton planted broadcast. The yield of cotton was also increased by watering the soil previous to planting. The best interval between irrigation in check irrigation of cotton was about two weeks and in flood irrigation two

to three weeks. When the soil was not watered before planting the best yields of cotton were obtained with one irrigation before blooming and with three during flowering.

The apparatus used for distribution of irrigation water at the Karayaz experiment station is described, and a large amount of statistical and other data on climate, crop yields, and methods and amounts of irrigation are also included.

Spray irrigation, M. B. WILLIAMS (*U. S. Dept. Agr. Bul. 495 (1917), pp. 40, figs. 19*).—"The object of this bulletin is to familiarize the farmer with conditions under which spray irrigation may be undertaken profitably, suggest possible water supplies, and illustrate typical pumping machinery and distribution systems so as to aid the prospective irrigator in determining whether spray irrigation should have a place in his farm operations. It is also intended to present information necessary in working out an intelligent design and installation of a spray system."

With reference to economic conditions justifying spray irrigation it is stated that, assuming a cost of $250 per acre on a stationary plant for a small acreage, the farmer should be able to increase his annual returns from each acre somewhat more than $51. Adequate markets, labor, and fertilizer facilities are other essentials for successful spray irrigation, as well as good roads and equipment for quick hauling of perishable truck and berry crops.

With reference to farm conditions adapted to spray irrigation, it is stated that "spray irrigation can be practiced to advantage on both light and heavy soils. By this method it is possible to apply evenly to sandy soils the small quantities of water which such soils will retain, without the loss of water by percolation which might occur with other methods. It is possible also to apply to heavy clay soils the small quantities of water required to soften such soils when they have baked after rains and to apply water no faster than the soil can absorb it, thus preventing loss by surface run-off. Lands to be irrigated should be drained as completely as possible of excess moisture. Many tile-drained fields are the most responsive to crops under spray irrigation. Spray irrigation is practically independent of the topography of the field and can be applied to land too rolling or rough for surface methods. It is, therefore, adaptable to the irrigation of sidehills on which soils tend to wash or erode. . . .

"For spray irrigation sufficient water to cover the land to a depth of 1 in. per week for humid regions and 1½ in. per week for arid regions is believed to be a safe estimate for designing purposes. A spray plant should be large enough to supply these amounts of water in a reasonable length of time. This is accomplished generally by installing the system to spray from one-fifth to one-half of the total acreage at one time, depending somewhat upon the type of distribution used and the available water supply. . . .

"Three types of spray irrigation construction have been adopted more or less widely for field irrigation—(1) hose and movable nozzle or movable lines fed from an underground pipe system and hydrant, (2) circular nozzles fed from an underground pipe system, and (3) overhead spray lines fed from an underground main feed pipe. . . . The hose and portable nozzle system of spray irrigation is the oldest and least efficient of spray methods. It is impossible to get an even application over the entire field or under one position of the nozzle. The constant attendance necessary and the liability of over or under irrigation makes the cost of operation high and the results dependent upon the skill of the laborer. The greatest field for this type of irrigation seems

to be indoor spraying, outdoor sod lands, seed beds, and small garden plats. The first cost is the smallest of any type of spray irrigation."

Tests of irrigation pumping plants, F. C. Piatt (*Jour. Electricity, 38* (*1917*), *No. 3, pp. 79–82*).—Efficiency tests on about 350 small irrigation pumping plants are reported. About 90 per cent of these plants consisted of small centrifugal pumps either direct or belt connected to electric motors. The results are summarized in the following table:

Results of tests of irrigation pumping plants.

Kind of pump.	Size of pump.	Number of tests.	Mean discharge per minute.	Mean suction lift.	Mean total lift.	Revolutions per minute of pump.	Mean input.	Mean over-all efficiency.	Mean estimated efficiency of pump.
	In.		*Gal.*	*Ft.*	*Ft.*		*Kilowatts.*	*P. ct.*	
Horizontal direct-connected centrifugal pumps	2½	2	175	12	31	1,750	4.3	24.6	29
Do	3	5	170	15	45	1,740	5.2	25.7	30
Do	3½	2	260	17	25	1,470	5.4	38.4	45
Do	4	25	410	13	35	1,440	7.8	35.5	41
Do	5	16	470	15	34	1,200	9.3	31.1	36
Do	6	23	675	13	32	1,250	11.6	36.4	42
Do	7	19	880	14	30	1,120	13.2	36.4	42
Do	8	12	1,125	16	32	1,050	18.6	40.0	46
Horizontal belt-connected centrifugal pumps	2	7	115	14	25	1,225	2.3	26.0	32
Do	2½	4	172	13	21	1,315	3.4	23.0	28
Do	3	13	337	9	22	940	5.9	21.6	27
Do	3½	1	310	11	23	1,140	....	10.3	13
Do	4	8	375	6	26	800	6.7	25.5	32
Do	5	5	410	14	35	780	7.3	38.0	47
Do	6	5	560	12	27	760	9.7	24.8	31
Do	7	7	690	10	30	650	11.8	32.2	40
Do	8	1	1,040	....	8	707	19.4	8.6	10
Do	10	1	1,650	24	28	570	30.5	29.8	36
Do	12	2	1,980	9	13	440	27.0	27.0	32
Vertical belt-connnected centrifugal pumps	2½	1	150	23	49	1,540	5.1	27.0	33
Do	3	12	315	16	53	1,250	10.9	28.2	35
Do	3½	2	375	8	38	915	7.6	35.4	43
Do	4	41	495	15	62	975	15.1	38.1	47
Do	5	60	730	16	57	870	20.2	39.6	48
Do	6	20	935	16	46	825	23.0	36.2	44
Do	7	4	1,015	19	43	840	22.2	37.4	45
Vertical belt-connected two-stage centrifugal pumps	1½	1	100	2	27	2,000	2.8	18.2	23
Do	3	1	300	12	80	1,150	11.6	39.0	48
Do	4	9	460	17	110	1,025	24.3	40.2	48
Do	5	10	650	17	94	1,000	34.9	38.5	46
Do	6	1	625	....	103	625	33.0	36.7	44
Three-stage centrifugal pumps	3	1	300	4	119	1,020	17.0	39.4	48
Do	4	1	150	....	112	1,030	30.0	31.6	38
Well turbines	....	23	750	6	87	930	27.0	40.8	49
Plunger pumps	....	12	60	....	133	....	4.1	46.1	57

The draining of orchard land, J. M. Ward (*Agr. and Stock Dept. Tasmania, Bul. 65* (*1916*), *pp. 8, figs. 7*).—Brief general information on the subject is given.

[Iowa] laws relating to drainage, 1916, compiled by Lola S. Elliott (*Des Moines, Iowa: State, 1916, pp. 92*).—This publication compiled under the direction of W. S. Allen, contains the text of the law.

[Analyses of water samples, 1916], L. Heimburger (*Fla. Quart. Bul. Dept. Agr., 27* (*1917*), *No. 1, pp. 173–175*).—Analyses of 16 samples of underground waters from different parts of Florida are reported.

Drinking water, A. T. Charron (*Rpt. Min. Agr. Prov. Quebec, 1916, pp. 113–115*).—Analyses of five samples of Quebec waters are reported and discussed. A sample of drainage water from a cheese factory which had been submitted to septic tank treatment showed "that the purifying supposed to be done in the septic tank was far from being perfect."

Nitrites in potable water, A. A. Bado and V. J. Bernaola (*An. Soc. Quim. Argentina, 4 (1916), No. 15, pp. 251–255*).—The works of others bearing on the subject are briefly reviewed, and it is concluded in view of the results obtained by the authors that the importance of the presence of nitrites in drinking water is exaggerated. It is considered more important to determine the source of the nitrites, if any exist.

Purification of drinking water with calcium hypochlorite, A. A. Bado and L. Dasso (*An. Soc. Quim. Argentina, 4 (1916), No. 15, pp. 242–250*).—The work of others bearing on the subject is reviewed and experiments on the purifying action of calcium hypochlorite on polluted river water are reported.

A 10 per cent solution of calcium hypochlorite containing 16 per cent of active chlorin was used. This was added to the water at rates of 0.05, 0.1, and 0.15 cc. per 1,000 cc. of water. Bacteriological examinations were made one, two, and five hours after treatment. Better results were obtained with this treatment from the bacteriological point of view than previous experimenters had obtained with a treatment with 0.015 gm. of calcium hypochlorite containing 35 per cent of active chlorin. The coli bacilli disappeared completely and the numbers of other objectionable organisms, which were numerous in the raw water, were reduced until almost negligible.

Further experiments in which 1, 2, and 3 cc. of calcium hypochlorite solution were used and examinations made after one, three, six, and nine hours showed that the diminution in numbers of objectionable organisms as related to that of the previous experiments was less in proportion to the amount of hypochlorite used. Experiments on the effect of calcium hypochlorite and aluminum sulphate when used together are also reported.

The results as a whole are taken to indicate that calcium hypochlorite is very effective in the destruction of coli, Eberth, and pyocyaneus bacilli, and that small doses diminish the vitality of these organisms. In cases requiring a relatively high active chlorin content (33 per cent) and a relatively short time of contact appreciable results have also been obtained. *Bacillus subtilis* was found to be more resistant to this action.

Sixth biennial report of the state highway commissioner of Washington, Oct. 1, 1914, to Sept. 30, 1916, J. Allen (*Bien. Rpt. State Highway Comr. Wash., 6 (1915–16), pp. 123, pls. 6*).—The work and expenditures of the Washington state highway commission for this period are dealt with.

Third annual report of the country roads board of Victoria (*Ann. Rpt. Country Roads Bd. Victoria, 3 (1916), pp. 70, figs. 20*).—This is the third annual report of the board, dealing with permanent works completed and in progress, road-making machinery, motor-car registrations, investigations, and finances.

Regulations respecting highways, 1916, W. A. McLean (*Ontario Dept. Pub. Highways Ann. Rpt., 1916, App., pp. 11*).—The text of the regulations is given.

Road construction for township road superintendents and overseers, W. A. McLean (*Ontario Dept. Pub. Highways Ann. Rept., 1916, App., pp.12, figs. 4*).—This is a brief manual of instructions as to the essential features and considerations in the construction of the ordinary country roads.

County roads, F. G. Macdiarmid (*Ontario Dept. Pub. Highways Ann. Rpt., 1916, App., pp. 7*).—The general features of the organization and construction of a county road system under Canadian highway improvement laws are briefly outlined.

Helpful suggestions for surveying country highways, S. P. Baird (*Engin. News, 77 (1917), No. 5, pp. 180–182, figs. 3*).—Some suggestions on special survey methods and devices from the practice of an experienced surveyor are given.

A step toward the rational design of concrete pavements, S. T. Morse (*Engin. and Contract.*, *47* (*1917*), *No. 6*, *pp. 135-137*, *figs. 4*).—The causes of cracking in concrete pavements are discussed and a summary is given of experience tending to develop the design of concrete pavements, special mention being made of the work of the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture.

The fundamental principle of concrete road design is considered to be that the central thickness should be made to depend primarily upon the width. The data summarized are taken to indicate that a concrete pavement to remain uncracked must have a thickness equal to at least 4.5 per cent of its width. On this basis the author suggests that the formula for design of concrete roads be modified in the following form: $d=\frac{2.25B^2}{f}+\sqrt{\frac{P}{1.5f}+\frac{5B^4}{f^2}}$. In this formula d=the thickness in inches, B=the breadth of the slab in feet, P=the concentrated load in pounds, assumed as 8,000, and f=the tensile stress in pounds per square inch in extreme fiber of concrete.

It is the author's purpose in this formula to indicate "that the minimum thickness should be not less than 5 in. Therefore, at the edges the pavement may be made 5 in. in thickness and be increased in thickness toward the center of the slab, as required by the formula." In comparison with current practice it is further pointed out "that narrow pavements are usually given a greater thickness than safety and economy require, and that wide pavements are usually given an insufficient thickness and hence are likely to crack longitudinally."

Possibilities of rural business from transmission lines, W. H. Burtis and F. D. Paine (*Proc. Iowa Sect. Nat. Elect. Light Assoc.*, *16* (*1916*), *pp. 155-165*, *168-170*; *abs. in Elect. World*, *68* (*1916*), *No. 5*, *pp. 221*, *222*).—It is the purpose of this paper to consider in a general way some of the questions relating to rural electric power business from transmission lines in Iowa and adjoining States.

It was found that of the 250 electric light and power companies in Iowa 60 are giving rural service. Of 52 companies reporting, the maximum number of rural customers per company is 80 and the minimum is 1. Twenty of the 52 companies give rural service to 179 customers from lines having voltages of 6,600 or above, of whom "17 companies serve 155 customers from their high-tension lines built to other towns, stepping the voltage down directly to 110-220. Ten of these companies use a high-tension voltage of 6,600 and serve 98 customers, the remaining seven use a high-tension voltage of 13,200 and serve 57 customers. Four companies serve 30 customers from their high-tension lines to other towns, first stepping the voltage down to 2,300 volts for distribution. The investigation shows only two companies have built lines to serve only farmers. These companies are using a voltage of 6,600 and serve only 10 or 12 customers."

"The highest voltage used on lines from which farmers obtain service is 33,000. This company gives service to 18 customers by first stepping the voltage down to 2,300 volts for distribution. . . ."

With reference to rates it was found that of 27 companies reporting, "all but two have the same charge per kilowatt-hour for rural service as for city service, and these two sell the energy at a lower rate per kilowatt-hour. . . . Seventeen of the 27 companies have the same minimum charge for rural service as for city service. Four of the remaining ten have a \$5 minimum; three have a \$3 minimum; and one a \$1.75 minimum. . . .

"From experience obtained so far it is reasonable to conclude that it is not very profitable to install a number of isolated high-tension transformers upon

a main trunk line serving cities. The cost of interruptions to the service is likely to more than offset the possible profit from such business."

It is further concluded that "the farmer should pay for the rural service lines These should be maintained and owned by the power company under its own franchise. The transformers and protective apparatus should preferably be furnished by the power company. The rate charged should be sufficient to cover the additional cost of giving such service."

A gasoline tiller, F. C. Perkins (*Gas Engine, 19 (1917), No. 2, pp. 61–65, figs. 5*).—This article describes and illustrates a new attachment for moldboard plows, consisting of a toothed rotor in perpendicular juxtaposition with the moldboard of the plow. "This rotor is operated by a gasoline motor. The engine turns the rotors at high speed, the teeth of the rotor engaging the soil as it comes from the moldboard, and pulverizes or disintegrates the soil perfectly, throwing it out at the rear, thoroughly mixed with the sod, weeds, grass, manure, and any other form of surface growth or fertilizer which happens to be present, all forming a perfect seed and root bed."

Farm buildings and building construction in South Africa, W. S. H. Cleghorne (*New York and London: Longmans, Green & Co., 1916, pp. XXIII+325, pls. 5, figs. 218*).—This book, prepared for farmers, students, teachers, and agricultural engineers, with special reference to conditions in South Africa, deals with the general arrangement and design of farm buildings, building materials, details of construction, stables, sanitary dairy sheds, bull boxes and exercise yards, small butter making and cheese making dairies, piggeries, silos, a reservoir, cattle and sheep dipping tanks, sheep shearing sheds and yards, a small cottage, and a cool storage room, the protection of buildings from lightning and white ants, etc. An appendix is also included containing sections on the calculation of horizontal reinforcing bars (hoops) in the wall of the silo, a design of a reinforced concrete tank or reservoir, and the calculation of graduations showing the volume of liquid in a cattle dipping tank at various depths.

The reconstruction of farm buildings in devastated areas, R. de Saint-Maurice (*Vie Agr. et Rurale, 7 (1917), No. 1, pp. 9–17, figs. 8*).—Methods of reconstruction of farm buildings in localities in France devastated by the war are described.

Mechanics of the household, E. S. Keene (*[Agricultural College, N. Dak.: Author, 1911], pp. 234, figs. 211*).—This publication, prepared as a contribution to physics, contains the following chapters: The steam-heating plant, the hot-water heating plant, the hot-air furnace, temperature regulation, management of the heating plant, plumbing, water supply, sewage disposal, coal, atmospheric humidity, ventilation, lighting and heating with gasoline, acetylene gas machines, and gaseous and liquid fuels.

Domestic water supply (*Colo. Agr. Col. Ext. Serv. Bul., 1. ser., No. 108 (1916), pp. 11, figs. 5*).—This is a popular bulletin on the subject, in which five steps in the process of providing running water in the farmhouse are described. These vary from the cold water supply over a sink in the kitchen to a bathroom and hot and cold water supply outfit. The use of the windmill for pumping is also described. A feature at variance with accepted sanitary practice which is recommended is the so-called gravel waste pit, situated close to the house and well, and used for the disposal of waste water. It is stated that "the waste pit consists of a hole, say 3 ft. across and 5 to 6 ft. deep, which is filled with gravel. This can be near the house in nearly every case, because only wash water and similar waste waters will be run into this pit."

House equipment for running water, J. L. Mowry (*Univ. Minn., Col. Agr., Ext. Bul. 61 (1916), pp. 8, figs. 12*).—This bulletin briefly describes gravity,

hydropneumatic, and pneumatic water systems and the hydraulic ram, and describes and illustrates fittings used in water supply and heating systems.

Privies and cesspools, C. G. WIGLEY and M. KNOWLTON (*Pub. Health News N. J., 2 (1916), No. 5, pp. 141–158, figs. 9*).—This article deals with privies, cesspools, and leaching cesspools, and includes diagrammatic illustrations of different types of each.

Disposal of sewage in rural school districts, C. G. GILLESPIE and MARGARET S. MCNAUGHT (*Cal. Bd. Ed. Bul. 17 (1916), pp. 16, figs. 7*).—This report deals in general with rural school sanitation and very briefly discusses sanitary privies and septic and Imhoff tank systems for rural school sewage disposal.

RURAL ECONOMICS.

Land tenure in the United States with special reference to Illinois, C. L. STEWART (*Univ. Ill. Studies Soc. Sci., 5 (1916), No. 3, pp. 135, figs. 22*).—The author discusses in general the situation regarding land tenure for the United States as a whole, and conditions in Illinois in detail. Among his conclusions are the following:

"It appears that the forms of tenure have been phases accompanying, limited by, and modifying the conditions and changes in the agricultural economy of the State. The prevalence, sectional character, and growth of farming by tenant operators is chiefly governed by the real value of the shares of the owners and tenants in the surplus of operation. Tenancy forms a sort of cumulative index of the effectiveness of the desire of the owners to escape the operation of their land, and of the ineffectiveness of the desire of tenants to become owners.

"Share tenancy has been more prevalent than cash tenancy, though cash tenancy predominates in the northern part of the State and has been more characteristic of tenants who were advanced in years and who were operating farms whose owners were resident at a considerable distance from their farms. . . .

"The farms of no single form of tenure can be held to be superior in all ways. Managed farms had the highest value in buildings and live stock per acre, and farms of owners were characterized by the highest value of implements and machinery per acre. In values of domestic animals the farms of tenants were below the average, when either the total value or the value per head is considered. The farms of tenants were largely devoted to the production of the money crops. This was particularly true of share tenant farms. Yields were superior in the case of farms operated by managers and by cash tenants. . . .

"It was shown by the age statistics that young operators were more generally characterized by tenancy, especially on the share basis, and that young owners were most heavily encumbered. Advancing years tended to replace share with cash tenancy, tenancy with ownership, and encumbrance with freedom from mortgage debt. The latest census data, however, indicate that an influence is at work restraining this movement. . . .

"Farming efficiency in the future will probably consist to a greater extent in the ability to increase net profits through cooperative dealing with the market. The efficiency test must, therefore, rule more strongly against operators of the tenures whose characteristics are opposed to successful cooperative effort on their part.

"It is not necessary, however, that the farmers of other tenures operate as efficiently as the owners themselves would operate. If owners prefer to have their land operated by others than themselves, and if their holdings are sufficiently large, they may content themselves with the financial disadvantage resulting from their refusal to operate their own land. . . .

"The test of productive efficiency may be somewhat slow in acting and costly but it bids fair in the long run to penalize unsound farming regardless of the tenure of the operators, and to guaranty, therefore, the survival of the best forms of tenure and of the best individual operators."

Tenancy in the South, F. A. MERRILL (*Bul. State Normal School* [*Athens, Ga.*], *4* (*1916*), *No. 1, pp. 14, fig. 1*).—The author discusses in general the tenancy problem of the South and concludes with the following statement:

"To our tenants we are indebted for our wonderful agricultural productiveness and we must draw our farm leases in such a way that we may aid them in keeping their hard-earned pittances at home. We must evolve some leasing system that will protect our people and that will not place a premium upon the importation of the very necessities of life. The problem of the South has ceased to be one solely of production and has resolved itself into one of wealth retention."

An economic study of farming in Sumter County, Georgia, H. M. DIXON and H. W. HAWTHORNE (*U. S. Dept. Agr. Bul. 492* (*1917*), *pp. 64, figs. 6*).—The authors summarize the results of this study as follows:

"Farm profits on these farms for the year of the survey (1913) were in direct proportion both to the number of acres in crops and the yield of cotton per acre. On farms of approximately the same size labor incomes were high when the yield of cotton was high and low when the yield was low. On owner farms of approximately the same size labor incomes were high when the percentage of crop area in cotton was high, and vice versa. The white farmers of the area are getting a much higher yield per acre than the colored farmers.

"Cotton occupies 59 per cent of the tilled area of the farms surveyed, and [at 12 cts. per pound] returns 89 per cent of the total farm receipts. Corn occupies over one-fourth of the tilled area and was grown on every farm visited. Oats are the principal small-grain crop and are also used for hay and pasture. Cowpeas for hay and seed occupy about half as much land as corn. About 85 per cent of the land utilized for a second crop in 1913 was in cowpeas.

"The cost of producing cotton, computed for 534 farms, was found to average about 10.5 cents per pound of lint. The cost of producing cotton on these farms decreases with increase in size of farm. The relative rate of reduction in cost due to increase in acreage is greater for the farms ranging from small to medium than for those ranging from medium to large. The cost of producing cotton on these farms decreases with increase in yield per acre. The reduction due to increased yield is relatively greater for farms with yields ranging from low to medium than for farms with yields ranging from medium to high. On farms with high yields of cotton per acre the cost per acre was high, but the cost per pound low.

"Aside from work stock, hogs constitute the most important class of live stock. . . .

"In efficiency in utilizing labor, mules, and machinery the large farms have a great advantage over the small ones. On the small white-owner farm one mule works 10 acres of cotton and 11 acres of other crops, while on the large farm one mule works 19 acres of cotton and 10 acres of other crops."

Farm management survey [of Monmouth County, New Jersey], F. APP (*New Jersey Stas. Rpt. 1915, pp. 184–193, pl. 1*).—These pages contain data obtained in the survey previously noted (E. S. R., 36, p. 492). Attention is drawn to the large amount of capital required in this region to conduct a profitable farming business.

The possible Wayne County farm, C. E. THORNE (*Ohio Sta. Bul. 304* (*1916*), *pp. 209–225, figs. 2*).—The author has analyzed the results obtained from his

fertilizer experiments at Wooster to determine whether they could be profitably applied to other Wayne County farms. He concludes that it would pay the farmers to apply more fertilizers even if less land could thereby be cultivated, also to purchase a part of the fertilizers to be used by tenants.

The resources and opportunities of Montana, S. Maxwell (*Helena, Mont.: State, 1916 ed., pp. 191, figs. 93*).—In this volume are described the agricultural, forest, and climatic conditions and the opportunities for further development and settlement in Montana.

How the Federal Farm Loan Act benefits the farmer, C. W. Thompson (*U. S. Dept. Agr., Farmers' Bul. 792 (1917), pp. 12*).—This points out the main provisions of the act (E. S. R., 35, p. 101) and shows how farmers can take advantage of it.

The Jewish agricultural and industrial aid society (*Jewish Agr. and Indus. Aid Soc. Ann. Rpt., 1915, pp. 61; 1916, pp. 60*).—In these two annual reports are discussed the activities of the society, the advancement of the agricultural interests of the Jewish race through the granting of loans, and the education and placing of Jewish laborers on farms.

Agricultural credit in France, A. Souchen (*Évreux, France: C. Hérissey, 1917, pp. 70*).—In this publication, prepared for distribution at the Panama-Pacific International Exposition, the author has given a brief history of the laws relating to long and short term credit and their provisions. He has also included a model law for local and district agricultural credit associations.

Cotton as a world power, J. A. B. Scherer (*New York: Frederick A. Stokes Co., 1916, pp. 10+452*).—The author traces the history of the use of cotton in the world's industry and its influence upon the social and economic life of the different nations.

Report on the storage and handling of wheat in bulk in South Australia (*Adelaide, So. Aust.: Govt., 1915, pp. 55, pls. 19, figs. 3*).—In this report some of the disadvantages of handling wheat in bags are pointed out. It is considered that the bulk system is better than the bag system because the excessive loss on bags to the farmer can be eliminated, wheat can be handled more quickly and cheaply between the farm and export wharf, more economical use of railway rolling stock will result, bulk elevators will save and provide more economical use of land area and wharf frontage at ports, and by reliable and disinterested government operated inspection the grading and weighing system will encourage the farmer to grow the best grades, and the financing will be done with less difficulty, more uniformity, and greater readiness.

There is also included a paper by James Spelman on the handling of grain in Canada.

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt., 3 (1917), No. 2, pp. 13–20, fig. 1*).—This number contains the usual data as to the estimated farm value of important products and the range of prices of agricultural products at important centers. In addition there are given special data regarding the methods of gathering grain crops, the extent of winter oats grown in the Southern States, wool production in 1916, the trend of prices and yield per acre of crops, the estimated value of farm production in 1916, the proportions of the total corn crop consisting of white, yellow, and mixed varieties, the condition of truck crops in the Southern States, etc., and special articles on the sizes of the family and farming in Iowa County, Wis., and alsike clover growing.

[Agricultural statistics of Finland] (*Bidr. Finlands Off. Statis., III, Nos. 7 (1914), pp. 161; 8 (1915), pp. 145; 11 (1916), pp. 145*).—These volumes contain data regarding the yield of crops and number of domestic animals by government and minor subdivisions, operations of creameries, wages of agricultural laborers, and monthly prices of agricultural products.

Agricultural and live stock statistics of Finland (*Statis. Arsbok Finland, n. ser., 13 (1915), pp. 116–143*).—These pages continue the data previously noted (E. S. R., 35, p. 497).

Annual report of the department of agriculture, Uganda, 1916 (*Ann. Rpt. Dept. Agr. Uganda, 1916, pp. 62*).—This report continues information previously noted (E. S. R., 34, p. 291), adding data for the year ended March 31, 1916.

AGRICULTURAL EDUCATION.

[The teaching of agriculture in high schools throughout the United States] (*Quart. Alpha Zeta, 14 (1916), No. 5, pp. 82, figs. 30*).—This issue is devoted to articles showing along what lines secondary agricultural education has been developed in the different States, especially with reference to method of organization of instruction, the school plant and the political area to be served by the different types of schools as follows: Agriculture in Alabama High Schools, by W. C. Blasingame; Agriculture in California High Schools, by W. G. Hummel; Agricultural Education in Indiana, by Z. M. Smith; Agricultural Education in Maryland, by J. E. Metzger; The Massachusetts Home-project Plan of Vocational Agricultural Education, by R. W. Stimson; Agriculture in the Secondary Schools of Michigan, by W. H. French; Agriculture in the Public High Schools of Minnesota, by A. V. Storm; Agriculture in Montana High Schools, by C. A. Bush; Agricultural Education in the State of New York, by L. S. Hawkins; Agriculture in the Secondary Schools of North Dakota, by W. A. Broyles; Agriculture in New Hampshire High Schools, by G. H. Whitcher; Vocational Agricultural Education in Pennsylvania, by L. H. Dennis; Development and Present Status of Agriculture in Secondary Schools of Texas, by J. D. Blackwell; Agricultural Education in the State of Vermont, by F. B. Jenks; Agriculture in the High School of Wisconsin, by H. N. Goddard; and Development of Special Agricultural Schools in the United States, by C. H. Lane.

Agricultural education in Argentina, W. Dawson, Jr. (*U. S. Dept. Com., Com. Rpts., No. 13 (1917), pp. 201–204*).—A brief review is given of the present status of agricultural education facilities in Argentina since the foundation of the first school of agriculture and stock raising at Santa Catalina on August 6, 1883. The instruction is classified as follows: (1) Higher—colleges of agriculture and veterinary science at the universities of Buenos Aires and La Plata; (2) that dependent on the Direction General of Agricultural Education, including four special schools for vine culture and wine making, agriculture and zootechnics, rural administrator, and agriculture and sugar making, respectively; seven practical schools of agriculture; 5 agronomic and 9 experiment stations, as well as 4 substations; district agronomists; and a farm school for women at Tandil, Buenos Aires; and (3) other miscellaneous national, provincial, and private institutions. The 1916 budget for the Direction General of Agricultural Education contained an appropriation of $917,591, devoted almost exclusively to current expenses, salaries, etc. To encourage the maximum production in farm schools for educational and financial reasons the institutions are now authorized to distribute 50 per cent of the net profits among their staff and pupils, the remaining 50 per cent being devoted to improving the establishment.

[Agricultural and forestry instruction in Austria and Denmark], edited by R. Miltner and E. Vital (*Land u. Forstw. Unterrichts Ztg., 30 (1916), No. 1–2, pp. IV+114+LXII*).—In addition to several articles noted elsewhere, this issue contains an article on The Reform of the Final Examination at the Agricultural Intermediate Schools [in Austria], by E. Vital; statistics and organi-

zation lists of the faculties of the agricultural and forestry education institutions in Austria in 1915–16; and a review of agricultural literature.

Agricultural instruction in Denmark, S. R. von Ramult (*Land u. Forstw. Unterrichts Ztg., 30 (1916), No. 1–2, pp. 84–88*).—This is an account of the present status of agricultural instruction in Denmark.

Report of the department of agriculture of Norway for 1915 (*Aarsber. Offentl. Foranst. Landbr. Fremme, 1915, III, Statsforanst., pp. LX+819, pls. 3, figs. 82*).—This is the annual report on the work of the various government agencies for the promotion of Norwegian agriculture, including chemical, seed, and milk control stations, experimental farms, sheep farms, dairy and horticultural schools, the school of home economics for training teachers, itinerant instructors, etc.

Technical education in tropical agriculture (*Trans. 3. Internat. Cong. Trop. Agr., 1914, vol. 1, pp. 1–56*).—These transactions include the papers in full on technical education in tropical agriculture, among others Agricultural Education in the Punjab, and A Note on Six Years' Experience in Teaching Agricultural Science in Northern India, by J. H. Barnes; and Agricultural Education in the Gold Coast, by W. H. Patterson.

Education through farm demonstration, B. Knapp (*Ann. Amer. Acad. Polit. and Soc. Sci., 67 (1916), No. 156, pp. 224–240*).—The author traces briefly the origin and history of the development of the system of farm demonstration teaching through men and women county agents.

The home demonstration work, Mary E. Creswell (*Ann. Amer. Acad. Polit. and Soc. Sci., 67 (1916), No. 156, pp. 241–249*).—An account is given of the organization and development of the home demonstration work conducted in the 15 Southern States under cooperative agreement between the several state colleges of agriculture and the States Relations Service of this Department. A systematic 4-year program of work has been adopted.

The junior home project work, F. L. Griffin (*Cornell Countryman, 14 (1917), No. 4, pp. 283–286, figs. 2*).—The author describes the junior home project work just being introduced into the rural and graded schools of the State of New York.

The work is organized and developed by the state department of education and is directed and supervised locally by the superintendents of schools. The New York State College of Agriculture is supplying the necessary directions and subject matter to the project students and their teachers. The projects—potato and corn growing, vegetable gardening, poultry raising, dairy herd record keeping, foods and clothing—may be undertaken by boys and girls in the seventh and eighth grades, or by those twelve years of age and over whether attending school or not.

A complete junior project consists of a definite amount of school study, at least 45 minutes a week or its equivalent, and supervised home work which must be visited at least three times during the season by the superintendent of schools or by some qualified person designated by him. A project notebook must be kept and a final report filed with the superintendent of schools. A pupil who successfully completes a junior home project and is recommended by the superintendent of schools will receive one regent's count toward high school graduation. An agricultural project requires a calendar year for its completion, and a pupil may receive only one credit each year for two years for doing junior project work.

The organization of the school farm, A. Ostermayer (*Land u. Forstw. Unterrichts Ztg., 30 (1916), No. 1–2, pp. 1–17*).—The author discusses the functions of the school farm, i. e., instruction primarily, demonstration, and investigation.

In his opinion the school farm should be conducted as a model farm, but need not provide everything that is desirable, this resulting in what may be called a "museum farm" which is occasionally seen. One type of farming, adapted to local conditions, should be pursued, the variations in which to suit different local conditions can be explained in the theoretical instruction. The farm should be organized for profit and should be under the direction of the instructor in farm management and bookkeeping.

The extent of the farm practice should be confined to the aims of the instruction of the school with which it is connected. These aims should be to gain (1) manual skill in farm operations, (2) a survey of the individual branches of the farm, i. e., of soil and animal production, and (3) a survey of the whole farm—its organization and management, together with the fundamental reasons and conditions for success. These objects can be accomplished more thoroughly on a school farm than on a private farm. The methods of farm practice adapted to the farm schools and the agricultural intermediate schools in Austria are briefly discussed.

School fairs (*Agr. Gaz. Canada, 4 (1917), No. 1, pp. 48–73, figs. 11*).—This is a report for the past year on the progress of school fairs in the Provinces of Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Alberta, and British Columbia.

Nature in farming, J. W. Paterson (*Melbourne, Aust.: Lothian Book Publishing Co., 1916, pp. XVI+221, figs. 137*).—This book, adapted for the use of schools and colleges and of the farmer as a source of reference, discusses scientific principles in their relation to farm practice, including plant growth, climate, soils, manures, drainage, irrigation, cereal, leguminous, root, and other crops, rotation of crops, insect enemies and fungus diseases, farm animals, feeds and feeding, wool and other fibers, milk and its products, and micro-organisms and decay.

Field crops for the cotton-belt, J. O. Morgan (*New York: The Macmillan Co., 1917, pp. XXVI+456, figs. 75*).—This book presents the science and art of field crop production in the South and has been written primarily to meet the needs of the college student and also to be of service to the farmer and the general reader. It treats in considerable detail of cotton and corn, as regards classification, description, and physiology of plant, principal species, varieties, breeding, soils, climatic adaptations, fertilizers, manures and rotations, tillage, harvesting and marketing, and insect enemies and diseases. In less detail oats, wheat, rye, barley, rice, sorghums, sugar cane, and the peanut are similarly considered. Each crop is taken up separately.

[Tree study] (*Davey Inst. Tree Surgery Instr. Book, 1914, No. 13, pp. 24, figs. 7; 1915, Nos. 14, pp. 23, figs. 11; 16, pp. 19, figs. 15; 17, pp. 19, figs. 21; 18, pp. 32, figs. 31; 19, pp. 23, figs. 19; 20, pp. 20, figs. 20; 21, pp. 24, figs. 26; 22, pp. 22, figs. 25*).—This series of lessons includes studies in landscape forestry, fruit growing, and tree surgery.

The science and art of home making, Carrie A. Lyford (*Ann. Amer. Acad. Polit. and Soc. Sci., 67 (1916), No. 156, pp. 40–46*).—The author briefly discusses the school in the study of home making, the home cottage or apartment as a laboratory, points of emphasis in the curriculum, the development of a unified curriculum, and the growth of the movement.

"To-day home economics is taught in all of our state agricultural colleges to which women are admitted; in practically all of our state normal schools, and in more than 3,000 high and grade schools. It has become a popular course in private schools but is not yet included in the curricula of the leading women's colleges. Correspondence courses of collegiate grade are carried on by four

state institutions. In four states—Louisiana, Oklahoma, Iowa, and Indiana—the teaching of home economics in all public schools is required by law. In many of the normal schools brief courses are required of all women students to give them a broader perspective for their general teaching, to enable them to introduce courses in the rural schools, and to prepare them for housekeeping. State supervisors of home economics have been appointed in four States. Eleven other States have some special system of home economics supervision. Twenty-three States have prepared courses of study in home economics for the common schools. . . .

"The funds made available by the Smith-Lever Act have led to a great increase in the amount of extension teaching in the rural districts. Women's clubs and other organizations are furthering the study of homemaking in towns and cities. The public press recognizes the movement as of universal interest."

MISCELLANEOUS.

Annual report of the director for the fiscal year ending June 30, 1916 (*Delaware Sta. Bul. 116 (1917), pp. 31*).—This contains the organization list and the report of the director on the work and publications of the station. It includes a financial statement for the fiscal year ended June 30, 1916, as well as a report of the extension service.

Annual Report of New Jersey Stations, 1915 (*New Jersey Stas. Rpt. 1915, pp. XXVIII+394, pls. 55*).—This contains the organization list of the stations, a financial statement for the State Station for the fiscal year ended October 31, 1915, and for the College Station for the fiscal year ended June 30, 1915, a report by the director and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue. Reports of the fertilizer inspections have been noted in Bulletins 285 (E. S. R., 34, p. 625) and 287 (E. S. R., 35, p. 128), and feeding stuffs in Bulletin 283 (E. S. R., 34, p. 665).

Report of the director for 1916, J. G. Lipman (*New Jersey Stas. Bul. 298 (1916), pp. 51*).—This contains the organization list and a report of the director on the work and publications of the station during the year. The experimental work recorded is for the most part abstracted elsewhere in this issue.

County experiment farms in Ohio, 1915 (*Ohio Sta. Bul. 303 (1916), pp. 207, figs. 28*).—Reports on the Miami, Paulding, Clermont, Hamilton, Washington, Hancock, Trumbull, and Mahoning county experiment farms for 1915 are given. The experimental work recorded is for the most part abstracted elsewhere in this issue.

The work of the experiment station and agricultural extension service for 1916 (*Wisconsin Sta. Bul. 275 (1917), pp. 92, figs. 41*).—Part 1 of this report, by H. L. Russell and F. B. Morrison, deals with the work of the station, the experimental features not previously reported being abstracted elsewhere in this issue. Part 2, Carrying Agricultural Science to the Farm, by H. L. Russell and K. L. Hatch, reports on the extension activities. Part 3 contains brief summaries of the station publications of the year, and part 4, a financial statement as to the federal funds for the fiscal year ended June 30, 1916.

The Department of Agriculture of the Union of South Africa: A short account of its history, organization, and activities (*Pretoria: Govt., 1915, pp. 32*).

Manual of agricultural laws, compiled and edited by R. E. Annin (*Boston: State Bd. Agr., 1916, pp. 195*).—A compilation of the Massachusetts laws dealing with agriculture as they stood at the prorogation of the legislature in 1916.

NOTES.

Connecticut State Station.—Waldo L. Adams has been appointed chemist, beginning May 1.

Montana College.—A law passed by the last legislature appropriated $10,000 for the reimbursement of the cost of transportation to and from their homes of students at the college, the state university, the state school of mines, and the state normal college. Expenditures not exceeding $5 are excepted. The purpose of the act is to equalize the cost of attendance at these institutions to students coming from distant parts of the State.

New Mexico College and Station.—Cleave W. Humble, a 1917 graduate of the college, has been appointed assistant agronomist, vice J. G. Hamilton, whose resignation has been previously noted.

North Dakota College.—A school of education has been organized with four courses covering four years and two courses covering two years for completion. The four-year curricula are designed for teachers of agriculture, the mechanic arts, science, and vocational and rural school administration, while the two-year curricula are for teachers in consolidated schools and special teachers. Arland D. Weeks, professor of education, has been appointed dean of the new school.

Ohio State University.—The first class of three-year students in the College of Agriculture was graduated March 16. The class numbered 62, of whom 52 will return to the farm, 5 will take up market gardening, and 5 cow testing association work. The total enrollment in this course is now 225, which is somewhat smaller than was anticipated.

Wm. L. Clevenger, instructor in dairying, has resigned to accept a position with the Dairy Division of the U. S. Department of Agriculture, in connection with its demonstration work in dairy manufactures in Tennessee and North Carolina.

South Carolina College and Station.—Dr. F. H. H. Calhoun has been appointed director of resident teaching. C. C. Newman, professor of horticulture and horticulturist, has been put in charge of the college farm. This farm comprises about 600 acres and is used in growing food for the students and feed and pasture for the live stock at the institution.

Texas College.—The junior agricultural college, established by the last legislature as previously noted (E. S. R., 36, p. 599), has been located at Stephenville, about 100 miles southwest of Fort Worth. The buildings and grounds of the John Tarleton College have been acquired for the purpose, and the citizens of Stephenville and Erath County have donated 500 acres of land additional, to be used for experimental and demonstration work in connection with the institution. They have also subscribed $25,000 for a student loan fund.

A second junior college has been established at Arlington, between Fort Worth and Dallas. The property of a small military academy has been transferred to the State, and efforts are under way to secure local contributions for additional aid and a student loan fund.

Provision has been made for a state educational survey by a board consisting of the presidents of the state university, the A. & M. College, the College of Industrial Arts, and one of the state normal schools, the state superintendent of public instruction, and the state commissioner of agriculture. A report is to be submitted to the next legislature. An appropriation of $2,000,000 was also granted by the legislature for the benefit of the rural schools.

Agricultural Education and Research in Latin America.—*School and Society* announces that a Pan-American university has been established in the Republic of Panama. The trustees are to consist of the Secretary of Public Instruction of Panama and the diplomatic representatives of the American Republics or their delegates, together with similar representatives of other nations which may maintain chairs in the university. It is hoped that the institution may be of international value, especially along the lines of medicine, law, and agriculture.

In Venezuela, a presidential decree of March 12, 1917, creates an experimental station of agriculture and forestry, with an acclimatization garden, to be located near Caracas, and intended to serve as a model for other such stations to be established in other parts of the Republic. The objects of the station are the improvement of the methods of cultivation of the principal agricultural products of the country; the introduction, selection, and distribution of seeds; experiments in reforestation; the suitability of soils to crops and of crops to the various regions; and practical work for the training of agricultural foremen and forest rangers. H. Pittier, until recently with the U. S. Department of Agriculture, has been appointed in charge of the station and will also superintend the making of a survey of the unoccupied land of the Republic, which has recently been ordered.

The Council of Public Instruction of Ecuador has arranged to establish an agricultural class connected with the faculty of science of Central University at Quito. The professor in charge of this course is also to edit an official bulletin to encourage the study of agriculture.

Organization of Agricultural Work in Java.—Agricultural work in Java is mainly organized under the Department of Agriculture, Industry, and Commerce, for which appropriations of about $3,000,000 per annum are available. The agricultural work consists of 14 main bureaus besides several experiment stations. Two of these, the experiment station for tea culture at Buitenzorg and for tobacco at Klaten are in close relation with the department, although supported in part by planters or their associations. Less closely related to the department, but receiving some of its funds, are the station at Salatiga, devoted to local work on coffee, cacao, etc.; that at Malang, occupied chiefly with coffee and rubber; and that at Djember, principally devoted to tobacco and rubber. There are also two stations without official relations, the sugar-cane station at Passoeroean with its six substations, and the Deli tobacco station at Medan, Sumatra. Efforts are taken, however, not to duplicate these activities.

Some of the principal enterprises within the department are the bureau of forestry, the botanic gardens, the institute for phytopathology and plant breeding, an office of agrogeology and agricultural chemistry, the veterinary institute and service, a laboratory of microbiology, and special work with rubber, coffee, and cinchona.

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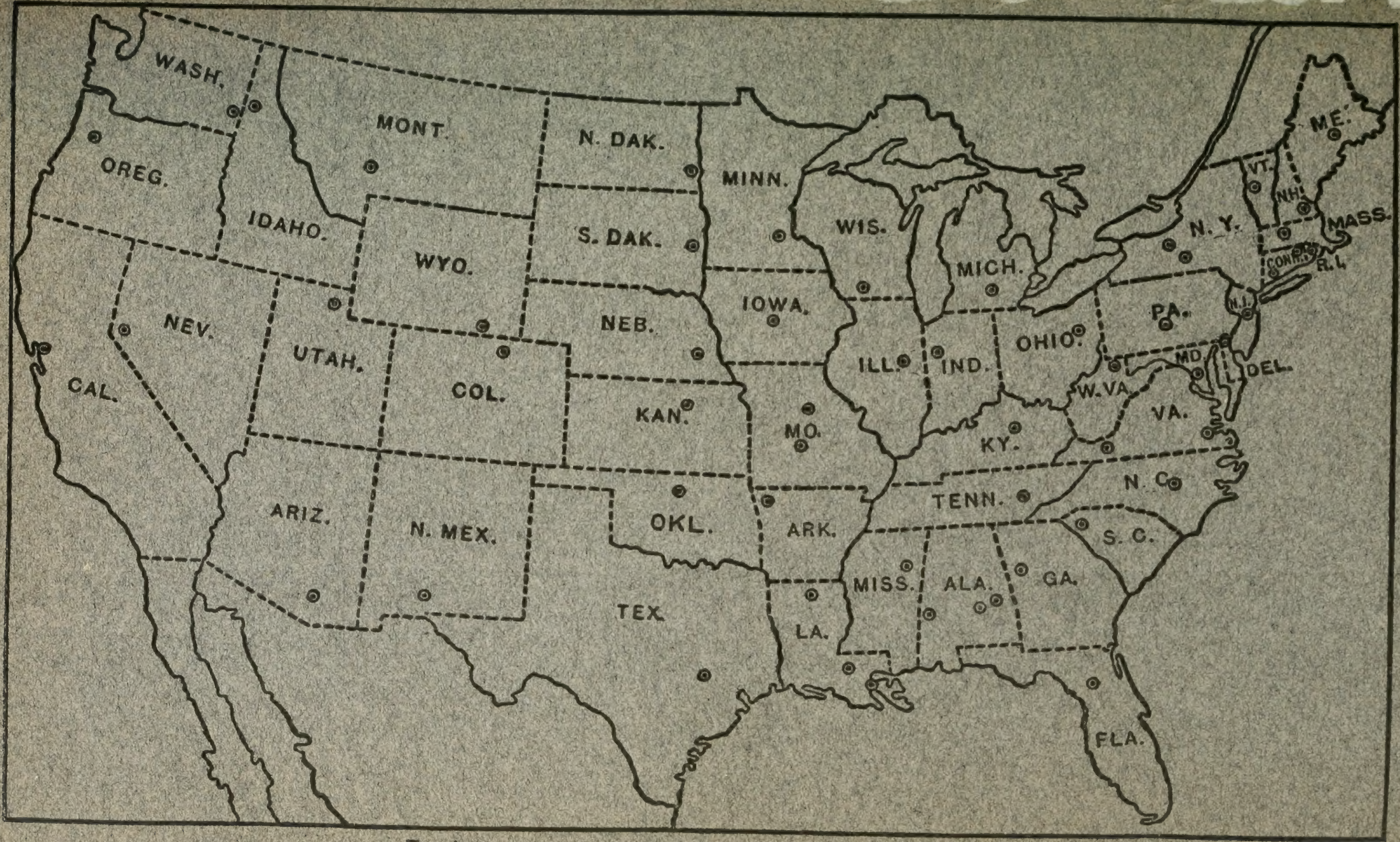

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